The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions relating to the proposed Export of Natural Gas from the Province of Alberta.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: November 8, 1950.

Volume 8.

I N D E X

VOLUME 8.

November 8th, 1950.

W I T N E S S E S

E X H I B I T S

VOLUME 8.

November 8th, 1950.

DAVID G. HAWTHORN, recalled,

examined by Dr. Govier, testified as follows:-

Q Mr. Hawthorn, I wonder if I might ask you some questions about Exhibit J-23. In the Tables at the back of this exhibit you show the deliverability schedules for Pincher Creek, Pendant d'Oreille and Manyberries. I wonder if you could tell us where the basic data on which those schedules were constructed came from? I am thinking of the open flow or back pressure test, or that type of data?

A Yes, those were based on the open flow curves at Pincher Creek that were prepared by Gulf, and the open flows of the Pendant d'Oreille wells.

Q In the case of Pendant d'Oreille and Manyberries, were you able to average the results of several tests in the field, or how did you arrive at an average condition?

A They were averaged, yes, sir. The average of two wells in Pincher Creek, and I think there were tests in the Pendant d'Oreille field.

Q In Table 3C I would gather than that the Pincher Creek, the average initial flow was taken at 64 million, is that right?

A That is correct.

Q And 16 million for Pendant d'Oreille?

A That is correct, yes, sir.

Q And where is the corresponding figure for Manyberries?

A Manyberries was not detailed in the Tables 3 and 4, but it was detailed in Table 2, and Table 2 is merely the

take-off of the figures from the detailed deliverability study presented in Exhibit 6.

Q Oh, yes, I see.

A Manyberries was small and it was thrown in with the other fields and listed under "Others".

Q Fine. And in the case of Exhibit J-24, what back pressure or open flow data is used here?

A The average of the two tests at Jumping Pound were used to detail the Jumping Pound deliverability.

Q Where does that average appear, Mr. Hawthorn?

A I am sorry, I did not include the detailed Table of that in Exhibit J-24.

Q Do you recall what average figure you used for Jumping Pound?

A As close as I can remember the starting point is 36 million cubic feet per day. I have the work sheets and I can find it right quickly if you would like. 35.

Q 35?

A Yes.

Q And do you have the corresponding figure for Viking-Kinsella?

A Yes, sir. Well, I remember now that started at 10.

Q At 10?

A Yes.

Q In each case, I take it that you have assumed 25% of the absolute open flow as the maximum?

A That is correct, stayed within that all of the way down.

Q Would you say a word or two about the slope of the back pressure tests, or did you use that approach at all?

A Yes. As I explained in our previous hearing, we adhered

to the .85 slope in all cases. I might here mention, while you bring that subject up, that there is one other recourse that I failed to mention in yesterday's discussion, and that is the fact that relaxation of the 25% would be another method of filling in these deficiencies.

Q As a matter of fact, I would like to discuss that point with you, Mr.Hawthorn. I have one other question, though, in connection with J-24 that I wanted to ask you on Page 6?

A Yes.

Q You stated at the beginning of the first complete paragraph,

> "In estimating the amounts of the gas to be available from Leduc we have assumed an increase in gas/oil ratio and gas production of 2 to 1 over the next 10 years."

Does that mean that your entire calculations for Leduc have been based on the assumption of the present rate of oil withdrawal, but as gas/oil ratio increasing to double the present gas/oil ratio in 10 years?

A In substance, it means actually what we did was to start at 20 million feet a day and go on up to 40 million feet a day, and carry it constant from there on.

Q I see. You do not go back to the oil production?

A No.

Q You just take a straight line increase from 20 million cubic feet per day to 40 million, and then hold it constant?

A And then hold it constant, that is right, and that will give the production as shown in the curve amounting to

nearly 400 billion feet in the 30 years.

Q Mr. Hawthorn, did you hear Mr.Dixon's evidence in connection with the probable or the possible trend in gas-oil ratio at Leduc D-3?

A Yes, sir.

Q Would you comment on that? Do you agree with that possible increased curve?

A I do not agree with the method of using the solution drive curve with the gas cap drive field and a water drive field, no, sir. It ends up with about the same thing. You get an increase in gas available, but I would not say that it is the proper approach to accept that theoretical solution drive curve, I mean, to apply that theoretical solution drive curve to a gas drive and a water drive field.

Q Do you agree with Mr.Dixon, however, that we can look forward to an increase in gas/oil ratio, even though the mechanism is gas cap and water drive?

A Oh, yes, sir, just what I have predicted here, it will go up.

Q It will go up?

A Yes. And, as I have gone further to say, that I think that is a very conservative estimate.

Q Yes?

A I talked with Mr.Pot on this situation before I wrote this paragraph, and then I made that decision and kept it at what I felt a very conservative figure. Imperial asked me not to quote those figures, and not to use them except for my own purposes here, but I understand now that they are going to put those in evidence, those figures that

Mr. Pot read off yesterday, and those, I think, support this whole paragraph here in pretty fair shape.

Q Well, would it amount to this, then, Mr. Hawthorn, various people have indicated to the Board, for different reasons and using different methods of approach, that the gas/oil ratio and, consequently, the gas available, is going to increase considerably over the next few years, and, although you may differ with Mr. Dixon's method, with Mr. Dixon in his method of approach, is it right that you agree with him in the approximate amount of gas that may become available?

A Well, I agree that the gas is going to increase. Just how much it is going to increase I do not think you can exactly put your finger on it. I have used what I consider is a minimum that it is going to increase double in the next 10 years, and I think after that it is going to continue to increase, but I have held a constant in my estimation because I have been obsessed with one thought in this whole thing, and that is that the Board wanted to know above everything else, the condition of these two gas companies, and they would probably like to know the worst conditions, or the very minimum condition that the gas companies are in, so that was the reason for the preparation of these two curves, and I do think they do show the minimum conditions.

Q On this other question, Mr. Hawthorn, of gas allowable, were you here last week when Dr. Brokaw advanced some views on that question?

A No, sir, I was not.

Q Have you read his exhibit, I think it was J-13?

A No, sir, I have not.

Q Well, briefly, Mr. Hawthorn, Dr. Brokaw advanced the theory that inasmuch as the danger or possible loss in recoverable gas at a well was due primarily to the differential at the sand face, that it might be more reasonable to set production allowables or production ceilings on the basis of a constant permissible differential at the sand face, or on some basis that would reflect that idea, rather than on the basis of a constant percentage of the absolute minimum flow, or the constant percentage of the shut-in pressure. Dr. Brokaw went on to say that he did not know of any place where that was being done, and he did not know just how it could be done, but he felt that from the point of view of the reservoir mechanism, the real danger at the bottom of the well, that some such scheme could be worked out which would be far more realistic, and it would have the advantage that in the declining years of the well the allowable would be considerably greater. I wanted to ask you, Mr. Hawthorn, if you had any views along that general line and, particularly, whether you agree with that thesis that Dr. Brokaw advanced?

A Well, I would say I think it is all right, but I think it would be a difficult thing to administer, and I do not know what is to be gained by it except protection of the well, and as we operate wells we learn the limits that they can be operated at, and we keep within those limits.

Q Yes?

A There is plenty of testimony before the Federal Power

Commission that we do not operate the Gulf Coast wells up to the 25%, and there is plenty of testimony showing that probably 10 to 12 or 15% of the wells are held within that percentage in the Gulf Coast for the dangers that there are in those wells in operating them at too high a rate of flow. So I would say that the only thing to be gained by it would be the protection of the well. And this 25% business is just something that has grown, it is a purely arbitrary thing and has little meaning except to hold the well within certain limits.

(Go to Page 679)

Q I think Dr. Brokaw's main point was that if you take a well, for example, which when first put on production and operated at 25% open flow suffered a sand face differential of say 200 pounds and if that is safe, then there would appear to be little reason why that well could not for its entire life be operated at a sand face differential which did not exceed 200 pounds. Whereas, if the well is operated at 25% of the declining open flow throughout its life, it would mean in the last, say after 10 years, the sand face differential may drop to 110 pounds. All of which seems to add up to this to me, Mr. Hawthorn, that if we say 25% open flow is safe at the beginning of a well, at the beginning of the life of a well, we are in effect saying that a sand face differential of 200 pounds is safe, if it is safe at the beginning of the well why should it not be safe at near or in the declining years of operation. Would not that mean that during the declining years the well might be operated at higher than 25% absolute open flow? If seems to me that is the point you tried to make, that there is no good reason whatever to deviate from the 25% open flow principle.

A Well it would certainly ease the deliverability problem in the declining years of the field.

Q I mentioned to Dr. Brokaw that the Board has been for some time considering the possibility of changing its previous regulation concerning its ceilings on allowables.

A It would certainly overcome that difference with the declining production at the depletion period of the life of a well, but I am not sure that when you mention 200 pounds differential

is safe at the beginning that it is going to be safe at the end. I am not sure that you could not operate a great many wells at much higher capacity than 25% without danger to the wells. But some wells, of course, like the Gulf Coast will have to be held at a little closer than that. If we operated some Gulf Coast wells at 25% open flow, I would be pulling sand in and water in and it would incur a lot of damage to the well. Which I do not think might occur in many other places whatever. So I think the danger to the well is the only thing to be considered except where we get into proration and where you have to prorate wells like in Carthage, where we have several hundred wells, and the Panhandle where they are given their respective allowables.

Q Why do you believe that just because it is safe to operate a new well at a differential say of 200 pounds, for example, it might not be safe to operate that well 10 years later at the same differential?

A It might be safe, but again I do not know that it would be.

Q Your pressure is expanded through your same volume?

A Your velocity across the sand face might be higher.

Q Do you think an increase at the sand face might be proportional to the lineal velocity of the gas or the mass velocity of the gas?

A I think probably it is somewhere in between. It is not entirely mass nor is it entirely velocity. I presume it would be somewhere in between.

Q Generally speaking, have you any words of wisdom for us in solving the problems with which we are faced?

A I am afraid not, Dr. Govier. I think your attempt to obtain something better than the 25% is certainly an admirable approach to the thing and we certainly will watch it with great interest if you do develop something. To develop anything like that is a problem of administration and without considering it my quick reaction to the 25% is it is a very simple thing to administer and to adhere to, inasmuch as it covers most of the cases and the rest of the cases might better be handled by individual examination and discussion. Such as in the declining period of the life of a gas field we can always go before the Railroad Commission and get an extension of the 25%.

Q Is that frequently done?

A I do not know that I can say so. I think probably in most of the cases this deviation from the 25% is just winked at and the operator is allowed to go ahead without anything being said about it.

Q I understand in Kansas, Texas and Oklahoma they are using what they are calling their deliverability method, which is to operate at flowing well-head pressure and some percentage of the shut-in well-head pressure. Is that an attempt of theirs to get away from the 25%?

A I cannot tell you that, Dr. Govier. I do not know. That is something new that I am not familiar with.

Q Thank you very much.

CROSS-EXAMINATION BY MR. MARTLAND:

Q I just have one question. You were questioned yesterday, Mr. Hawthorn, by Mr. Smith regarding certain differences

between your estimates and those of Dr. Hugh Beach with reference to the fields in the Pakowki Lake area. I notice on page 4 of your submission J-22 there is the statement "The material for making such a refined correlation has not been available to us, so we have accumulated the productive sand in each well and have made a composite isopachous map and one determination for effective volume of productive sand." So you want to say anything about that in further explanation to Mr. Smith?

A As you know, Dr. Beach, in his submittal of the reserves of Pendant d'Oreille, has correlated and made estimates of five different sands. To do that requires a detailed examination of all the core analyses, drilling records, and in fact all of the information that is possible or that is available. That information has not been available to us. I tried to get the core analyses from Dr. Beach but I was informed that core analysis information was considered as confidential information and we were not permitted to have it.

Q Thank you.

MR. MAHAFFY: I would like to call Mr. H. R. Milner in connection with his submission of the Alberta Inter-Field Gas Lines Limited and before doing so, Mr. Chairman, I would like to just give one word of explanation. We have prepared a very short brief which was distributed yesterday and which Mr. Milner, with your permission, will read today. This brief is intended simply as a summary of the submission of Alberta Inter-Field Grid. You will remember, sir, that when the case of Westcoast was being presented, two exhibits

were filed, namely, Exhibit 69 and Exhibit 70, 69 being a submission of Mr. Milner's at that time, and Exhibit 70 being the engineers' report prepared by Stone & Webster. Now, Stone & Webster's report dealt almost exclusively with the final make-up of the gathering system which would suit the Westcoast export plan, should a permit have been granted to that company. We have felt that the engineering phases of our proposals are completely outside the present scope of this joint hearing. Consequently, we do not intend to call any evidence along that line. The only evidence which will be submitted is the statement of Mr. Milner, and I would like now to call Mr. Milner.

H. RAY MILNER, having been duly sworn, examined by Mr. Mahaffy, testified as follows:-

THE CHAIRMAN: This submission will now be marked Exhibit J-26.

SUBMISSION NOW MARKED EXHIBIT J-26.

MR. MAHAFFY: Mr. Milner, I understand you are the President of Alberta Inter-Field Gas Lines Limited?

A Yes.

Q And I believe you reside in that land of the North, Edmonton?

A The oil capital of the Province.

MR. C. E. SMITH: And the rugby capital to be.

Q MR. MAHAFFY: How long have you resided in Edmonton, Mr. Milner?

A 39 years.

Q I believe you were at one time president of the Northwestern

Company, the gas distributor in the Edmonton area?

A Yes.

Q And of the Canadian Western Company in Calgary?

A Yes.

Q For how long were you President of those companies?

A I became President in 1932 and continued as President until 1949, when I became Chairman.

Q You are now Chairman of the Boards of those two companies?

A Yes.

Q I believe you are a director of several other companies, Mr. Milner?

A A few.

Q Would you mention a few of those please?

A Well, the North American Life, Traders' Finance, Canada Cement, The Royal Bank, The Montreal Trust, International Utilities, Home Oil, Anglo-Canadian Oil. Is that enough?

MR. C. E. SMITH: What happened to the word "etcetera" we had yesterday?

Q MR. MAHAFFY: Now, Mr. Milner, I wonder if you would read to the Board Exhibit J-26, and if you wish, as you do so, you may make comments as you go along.

(Go to page 685.)

SUBMISSION TO THE PETROLEUM AND NATURAL GAS CONSERVATION BOARD AT JOINT HEARING, COMMENCING OCTOBER 30th, 1950.

Alberta Inter-Field Gas Lines Limited filed a brief with this Board, dated February 10th, 1950, in connection with the application for a permit to export gas by Westcoast Transmission Co. Ltd. At the same time it also filed a comprehensive engineering report prepared by Stone & Webster. These documents were marked as Exhibits 69 and 70 respectively.

In view of the fact that the Board has decided to hold a joint hearing to deal specifically with the gas reserves of the Province, the estimated future requirements of the Province and the deliverability of the fields, this additional brief has been prepared because of our conviction that a properly designed provincial gathering system, which would eventually pool the available gas reserves of the Province, would be of considerable value in promoting adequate deliverability from the fields. It is hoped that it may be of some assistance to the Board in connection with the specific problems being considered at the joint hearing.

It appears to the officials of this Company that the Government of the Province of Alberta, and through it, this Board, has certain objectives in mind with respect to its natural gas resources and also some serious problems to face. In this brief an attempt will be made to set forth some of these objectives and problems and to show that a gas gathering

system, subject to Provincial regulation and control, of the type proposed by this Company would be of assistance in meeting those objectives and in solving the problems.

When the application of Westcoast Transmission Co. Ltd. was being heard by this Board the above mentioned brief and engineering report by Stone & Webster were filed as exhibits. The Engineering report was prepared at considerable expense to show a proposed gathering system suitable for the supply of local provincial requirements and of the export requirements of that particular applicant. That report also set forth a gathering system which could be used in the event an export permit were granted to North West Natural Gas Co. Ltd. A similar report was prepared, but never filed, showing details of a gathering system designed to supply export gas to Western Pipelines Ltd. As further applications were received by the Board it was deemed inadvisable to spend additional sums of money on engineering work for the particular scheme of each applicant because the basic principles involved had already been established. If, as and when an export permit is granted to any particular applicant, Alberta Inter-Field will be prepared to immediately submit a scheme of provincial gas gathering to suit that particular plan and to insure diversification of supply to local consumers.

It may be the impression in some quarters that Alberta Inter-Field intends to establish immediately a vast and expensive network of pipe lines and gathering facilities in the Province and the

fear has been expressed that this would add materially to the cost of gas consumed, both within and without the Province. This is not the intention. It is intended that to the extent possible a definite plan should be formulated, in advance of export, to provide for the widespread handling and gathering of gas in the Province but that only such portions of the system should be constructed from time to time as are necessary and as markets warrant. In other words, that, with the approval of the appropriate Provincial authorities, there should be an orderly development of the gas gathering system in the Province.

Following are some of the objectives and problems referred to above together with a brief outline of the part to be played by this Company in achieving those objectives and solving those problems:-

1. It is essential that the future natural gas requirements of the Province be adequately protected in accordance with many public statements of members of the Government.

This Company agrees that such protection should be given. Conscientious efforts have been made in these proceedings to estimate the future requirements of the Province. The estimates of consumption over a future 30 or 50 year period can be nothing more than dignified guesses and the Province may have need for much more. For example, a national or continental policy of dispersal or decentralization of industry might very easily result in building up very

heavy industrial gas requirements in Alberta. On the other hand, as has been pointed out in evidence to the Board, there are many disappointments in the expected production or in the expected rate of production of proven or probable gas reserves which are depended on to meet estimated local requirements. With these problems in mind, it is submitted that much, if not all, of the risk of short supplies of gas for Alberta consumers will be eliminated by the development of a provincial gathering system. Such a system would eventually pool the gas reserves of the Province and make the full volume of the pool available for provincial requirements. At the same time it would act as a provincial gathering system for exporters.

2. It is essential that the citizens of Alberta be protected with respect to the price of gas to the extent that the price paid by them in the future shall not be adversely affected by export sales.

We agree with this objective and yet realize that it is a problem not easily solved. It might be necessary to establish what has been called a price differential and that might be difficult in face of natural laws and in face of the constitutional laws which might be brought into play. It is submitted, however, that such a scheme is made reasonably possible through the agency of a provincially controlled gas gathering system. That system and the natural gas handled by it would at all times be within the legislative jurisdiction and control of the Government of this

Province, which has power to establish transmission costs through the system, or any part of it, and also to fix the purchase price and the sales price of gas used for local consumption.

I merely pause there to remark that if any differential is to be established it certainly should be established before any export is authorized. It would be probably impossible to do so later.

3. To make natural gas available to as many of the people of this Province as possible.

A provincial gathering system of the type proposed, which is subject entirely and exclusively to Provincial control, is more likely to be willing to supply local communities within economic reach, than is an exporter of gas. If necessary, a provincial gathering system, completely under provincial control, could be required by Provincial authorities to make such supplies available. An Inter-provincial export line would not be subject to such Provincial control and direction. Furthermore, it is likely that the provincial gathering system would be within economic reach of more Alberta communities than would the export lines.

4. It is of the utmost importance that all of the gas resources of the Province be preserved for useful purposes and to that end that adequate and workable conservation measures be adopted.

A provincial gathering system, properly designed and engineered, would undoubtedly

be of great value in broadening the existing schemes for gas conservation. Oil field gas, distillate field gas and gas from dry gas fields could all be connected to the gathering system permitting great flexibility in the use of gas for both local and export markets. The maximum use could be made of oil field gas, distillate fields could be allowed to produce at the steady rate necessary for their most efficient recovery, dry gas fields would be available for peak load requirements and depleted or partially depleted sweet gas fields would be available for storage. The system would do much to make conservation of gas from Alberta fields reasonable and practical.

5. To the extent possible the available markets for gas should be prorated to the gas producing fields of the Province and to the producers in each such field.

This objective can be supported on the ground of fairness to all producers and also on the basis that it is only by so doing that the fullest use of our natural gas resources can be achieved. A provincial gathering system under provincial control could be called upon by the Conservation Board, or other Provincial agency having jurisdiction, to pick up gas from fields within economic reach of the gathering system. Under any other system some fields might easily be left without any market outlet for gas.

6. In dealing with natural gas reserves and the use to be made of gas withdrawn from those reserves, everything possible should be done to encourage future

exploration for oil and to insure that production of presently proven oil reserves is not unduly restricted because of inability to market gas produced with oil.

It is of the utmost importance to the people of this Province and of Canada that the oil development now taking place should proceed unhindered and that additional large reserves of oil be established. It is likely, as evidence given to this Board has indicated, that in the near future either such oil development will be hampered because of lack of adequate markets for gas produced with the oil or that large quantities of gas will have to be wasted by flaring. It is submitted that a gas gathering system of the type proposed by this Company, and subject to Provincial jurisdiction, would be of material assistance in making such oil field gas available to markets or by making it available for storage in depleted or partially depleted dry gas fields. Furthermore, the pooling of the gas through gathering system facilities makes it possible to equalize the B.T.U. content of gas from various fields for market needs.

7. To eliminate as far as possible and to the extent that present knowledge will permit, all expensive duplication of gas gathering lines and distribution systems.

This Company does not suggest that a gathering system can be designed today which will take care of all the exigencies of the future,

but it is submitted, that if adequate and orderly development is planned now and in the future, a large amount of pipe line duplication can be avoided. This should result in reduced capital expenditures with consequent savings in operating costs for local consumers and exporters alike.

8. It is desirable, in the interests of the people of Alberta, to insure as far as possible that the control of the operation of gas fields, the gathering of the gas produced, the use to be made of the gas within the Province, and the transporting of gas to export lines, shall at all times remain with the Province of Alberta through the administrative agencies named by it to supervise and control such matters.

It is well known that under our Canadian constitution Inter-Provincial Pipe Lines come within the legislative jurisdiction of the Government of Canada and that the operators of such pipe lines and all their activities will be under the control of the Federal Transport Board. It seems equally clear that any provincial pipe line or system of pipe lines or gathering system which is connected to an Inter-Provincial line and which is owned or operated by that Inter-Provincial line, would also be within the jurisdiction and control of the Federal authorities. Alberta Inter-Field submits that it is highly desirable that any gas gathering system in the Province of Alberta should be and remain under the exclusive legislative jurisdiction and control of this Province. Such provincial control is necessary to permit

the Government of this Province giving full effect to its announced policy of protecting the gas supplies of its own citizens and to permit this Board to make its present and future conservation schemes fully effective.

It therefore follows that the gas gathering system should be constructed and operated by a company of the nature of Alberta Inter-Field and that adequate provision should be made to effectively prevent the control of such company passing into the hands of operators of an Inter-Provincial pipe line. Provision must also be made to prevent the assets of the provincial gathering Company being transferred to any such operator of an Inter-Provincial line.

Alberta Inter-Field does not, and will not own or operate pipe lines outside of the Province of Alberta. It has been incorporated under the laws of the Province of Alberta. It is not, and will not be owned or controlled by Companies which own, or plan to construct Inter-Provincial pipe lines. It is quite prepared to insure to the satisfaction of this Board and to the satisfaction of the Government of Alberta that control of its affairs will not pass to any Inter-Provincial pipe line owner or operator or to any distributor of natural gas, and that its assets will never be transferred to any such owner or operator.

The Memorandum of Association of the Company provides in part as follows:

"5th (a) The Company is authorized to issue 1,900,000 Class A Shares, without nominal or par

value, and 100,000 Class B Shares without nominal or par value.

(b) The Class B Shares shall have the following special rights and shall be subject to the following restrictions, namely:

(1) A Class B Share or Class B Shares shall only be issued and allotted to a person who is a Canadian citizen, resident in the Dominion of Canada, who satisfies the Board of Directors that such share or shares will be held by him as the sole, absolute and beneficial owner thereof.

(11) No Class B share or shares may be transferred by the holder or holders thereof unless the consent of a majority in number of the directors of the Company elected by the Class B shareholders has first been given in writing, and such consent shall not be given to any transfer of a share or shares to any person, whether as sole or joint owner, who is not a Canadian citizen, resident in the Dominion of Canada; or who fails to satisfy such directors that, upon the registration of such transfer he will be and remain the sole, absolute and beneficial owner thereof.

(111) The said Class B shares shall confer on the holders thereof, in addition to all other voting rights, including the right to vote in respect of the election of the remaining directors, the sole and exclusive right to elect one-half of the directors of the Company plus one additional director of the Company, if the Board of Directors of the Company consists of an even number of directors, or one-half of the even number next below the number of directors of the Company, plus one additional director, if the Board of Directors of the Company consists of an odd number of directors. Provided, however, that the right to elect such directors shall be limited exclusively to those holders of Class B shares who are Canadian citizens, resident in the Dominion of Canada and who are the sole, absolute and beneficial owners thereof, and provided further that no person may be elected as a director of the Company by the Class B shareholders, as aforesaid, unless he is a Class B shareholder, who is the sole, absolute and beneficial owner of the Class B share or shares, registered in his name, and who is a Canadian citizen, resident in the Dominion of Canada.

(IV) The said rights and restrictions attaching to the Class B shares shall not be changed, altered, varied or interfered with, in any way, except by a resolution passed by a majority in number of the shareholders of that class holding at least 75% of all of the Class B shares issued and allotted.

(c) Save as aforesaid, the Class A shares and the Class B shares shall rank, in all respects, pari passu."

With this capital structure the holders of the Class B shares who elect a majority of the Board of Directors, must at all times be Canadians, resident in Canada. No corporation, domestic or foreign, can own any Class B stock either legally or beneficially. It is intended that these Class B shares will be widely distributed amongst individuals in Canada and particularly in Alberta.

In the result the management will be independent of any distributing and natural gas export companies and will not be subject to domination by any special interest.

On the other hand, there will be no restrictions on the ownership of the Class A shares and it is hoped that any corporation obtaining the right to export gas from the Province, and distributing companies within the Province, will acquire interests. As was said in our brief dated February 10th, 1950, "Provision will be made for any corporations which obtain export permits to take a substantial interest in the Inter-Field Company".

The directors of the Company are: Roy Marler of Bremner, E.R. McFarland of Lethbridge, Angus McKinnon of Dalemead, H.R. Milner of Edmonton, R.M. Montague of Edmonton, John Proctor of Edmonton, Fred Stapells of Calgary, and T. George Wood of Raymond.

In conclusion may we say that the gas distributing companies operating in this Province under the supervision of the Board of Public Utility Commissioners have given excellent service at extremely low rates in the areas they respectively serve. Neither the service nor the rates would have been so satisfactory if competing gas utilities had been permitted to serve those areas. Such a situation would have involved the duplication of facilities, heavier operating costs and higher rates. One provincial gathering system operated as a Public Utility is obviously in the general interest.

Q MR. MAHAFFY: Mr. Milner, the Northwest Natural Gas Company and the Alberta Natural Gas Grid Limited filed an exhibit here number J-13, and on page 27 of that exhibit we have this statement in dealing in this part with the idea of a grid system, and the writer said this:

> "If the applications of Western Pipe Lines and Inter-Field are successful, the natural gas of Alberta will be in almost complete monopolistic control, and those in control of this monopoly will not be Albertans."

Now, I wonder if you would comment on that?

MR. C.E. SMITH: I wonder before Mr. Milner answers that, we had a whole morning over what I would call a dog fight the other morning. Let us not renew it. I surely think it is outside of what this joint hearing is called for, because of the fact that that submission, I think, was accidently let in by Mr. Dixon two or three days ago. There should be some time when this Board can say, "Do we need to hear this over again?" Maybe, Mr. Mahaffy, you might agree with me.

MR. FENERTY: I would like to associate myself with those remarks.

MR. C.E. SMITH: I think Mr. Milner wants to make a speech about it.

THE CHAIRMAN: I think the Board allowed it to be discussed the other day and I think anybody who wants to speak about it should be allowed to do so. I think we should have struck this out. We were probably lenient in not doing that and I think that anybody who wants to speak on it should have the right to.

Q MR. MAHAFFY: Mr. Chairman, we won't take advantage of the ruling you just made, but the fact is, these statements are on the record and I did wish Mr. Milner to make a very brief statement on this particular point. It will only take a matter of a couple of minutes.

A I can make it very simply and very quickly. This Inter-Field, the conception of Inter-Field, is that it shall be a buffer against the danger of monopoly. The whole conception of it is that it will be a thoroughly independent

company and not tied up with either of the distributing companies in the Province or with any export company. It rests on its own feet and the Board of Directors, it seems to me, is a pretty good assurance of that.

(Go to page 699)

Q You have endeavoured to insure that state of affairs by the provisions in the Memorandum of Association which you referred to in Exhibit 26?

A Yes, sir.

Q Now, on the other hand, Mr. Milner, what is your view with respect to the monopolistic, so-called, tendencies involved in the scheme put forth by the Northwest Company?

A Well, that is clearly monopolistic, if you want to go into the question of monopoly, and whether the grid company is the direct property of the exporting company, or whether the grid is owned by a subsidiary of the exporting company makes no difference. The injection of a few Canadian shareholders in the subsidiary company does not change its paternity, change its control, or change anything about it?

Q Yes?

A And, moreover, should the export company also control the internal Provincial gathering system, the perating companies in the Province and the distributing companies in the Province eventually would find themselves undoubtedly in a very difficult position, and, probably, in an untenable position.

Q Yes?

A Of course, that will be after my day, and after the day of some of us around here, but it is something that should be provided for while providing can be done.

Q In other words, you feel that the local distributing companies would be completely dependent on the export or grid system for gas supplies, is that right?

A Eventually.

Q Eventually?

A Yes.

Q Now, just one other question, Mr. Milner, please. We had a little discussion the other day about the Stone & Webster proposal for a grid system. I just want one or two statements from you to clear it up. Reference was made by Mr.Dixon to Leduc, and he interpreted the Stone & Webster Report as providing for the repressuring of Leduc gas in Kinsella, and he reasoned that that would result in increased gas rates to the consumers in the City of Edmonton. What have you to say about that?

A Well, to my knowledge, no such idea was ever promoted or discussed. Moreover, in the early stages of the development of the Leduc field, the Imperial Oil felt that they would require the gas for recycling or for storage in the field, and that there would be no gas for many years available for export from the field.Later they changed their policy and an agreement was entered into with Northwest Utilities under which Northwest gets the Leduc gas and, as I understand the matter, it will be able to, Northwest Utilities will be able to take all the Leduc gas that is available for many years. Now, I remember very distinctly being notified by Imperial Oil of their change in policy in regard to the Leduc gas. I was notified with regard to it. It is quite impossible to consider Leduc gas for storage in Viking-Kinsella, and the idea that anybody is going to increase the price to Edmonton by storing gas in Kinsella is ludicrous.

Q Thank you, Mr. Milner. Will you just answer the other counsel please?

.....

CROSS-EXAMINATION BY MR. FENERTY:

Q Mr. Milner, on page 3 of your submission, you refer to the possibility that there may be increased consumption of gas in Alberta for the reasons you have outlined, and, on the other hand, there is always the possibility of disappointment in the production of gas, and then you say,

> "With these problems in mind, it is submitted that much, if not all, of the risk of short supplies of gas for Alberta consumers will be eliminated by the development of a provincial gathering system."

Now, I take it from that that you are not visualizing a short supply in the foreseeable future if there is no export?

A That is right.

Q This is in connection with export?

A Yes, this is in connection with export.

Q And then you feel, I take it, that that risk to the Alberta consumers arising from export, may be eliminated by this grid system that you speak of?

A I do not say it will be eliminated; I say it will be reduced.

Q Well, we will say reduced?

A Yes.

Q You still feel that there is going to be some risk, do you?

A There is always risk. The more commitments you make, the more risk.

Q That is interesting. This is a scheme in which you reduce the ever present risk to Alberta consumers if there is export, is that the way that you put it?

A Yes.

Q Then it is a scheme which is incidental entirely to export?

A Yes.

Q And I am interested, and I will be coming to the next page in a moment where you do refer to costs, how these things could be dealt with, because from the beginning I have taken the view that we have two problems here for the consumers, one is reserves and the other costs, and so far you are the only witness that I have been able to get to mention costs, so that I would like to talk to you about it.

A All right.

Q You discuss a possible differential, and, as probably you know, I have been talking about that for a good many months?

A Yes.

Q I want to approach it from a little different angle for the moment?

A Yes.

Q I suggest to you if this grid system, as you now say, is a necessary incident to eliminate risk because of export, that it is truly an incident of export? That follows?

A Yes.

Q And would it follow, if that is the case, that the cost

of the grid system should be borne by export?

A Not entirely. It might be very much in the interests of the Province, if export is permitted, to have a grid system in which the local distributing companies and the local municipalities, if they distribute their own, could draw gas to supplement or conserve their gas.

Q Yes?

A In other words, there might be distress gas in the Province?

Q Yes.

A Which would be very much in the interests of everybody that it should be used first.

Q Yes?

A And which would be cheaper.

Q Yes?

A And it would not be available in the absence of a grid system.

Q Yes. Well, then, perhaps we should put it this way, and perhaps we can reach an agreement in this, that if it is not entirely an incident of export, those increased costs, that fractional part of the increased costs,which might be necessitated by a grid system, insofar as local consumption is concerned, should be offset, possibly, by a differential in price?

A Yes.

Q I see?

A Of course, do not forget this, Mr.Fenerty, that the price of gas all over the Continent is steadily rising. You are going to feel the effects of it here, more or less, no matter what you do.

Q There is that possibility, of course, yes.

A Yes, because gas is an extraordinarily cheap fuel in Alberta today.

Q But, having in mind what you have told me, if this grid system, as far as are concerned at the present time, and we will have to deal with the future later....

A Yes.

Q .....is a necessary incident of export.....

A Yes.

Q .....and having in mind the announced policy of our Government that there shall be protection for consumers both as to reserves and price.....

A Yes.

Q .....can you suggest any other way of giving that protection as to price except by a price differential, or perhaps all of these incidents that we are seeking to guard a gainst being paid for by export, aren't those the two things that we have to look to?

A Yes, I agree with you.

Q Now, there is just one other question I want to ask you, and I am getting a little concerned about the proposed plan, I haven't got the figures here at the moment, but when the examinations were being conducted yesterday, it appeared that this plan involved the taking out of, what was it, 64 million a day from the Kinsella field for peak load propositions and replacing it in the summer from southern areas. And it seemed to me that the way that works out, if the report meant what it said it was, that insofar as the peak loads are concerned - peak loads only I am talking about now.....

A Yes, sir.

Q ....that if we are to restore to the Kinsella field in the summer gas in volume equal to that taken away in the winter for peak load requirements,that we are, in effect, leaving the Kinsella field supply intact except for the normal loads of the northern system, and supplying the peak from, we will say, Pincher Creek and other areas here, which will deplete those areas than otherwise would be the case necessarily?

A Yes.

Q And I have suggested that that will necessarily at some stage increase the cost to consumers of gas from those fields, that is, it will be higher priced gas later?

A Yes.

Q Now, if you are going to do that,at what I call the expense of the fields tributary to the Calgary district, I still think of them as being tributary to the Calgary district, doesn't it mean that you have got to have some protection from this increased cost or those increased costs by a price differential or some other scheme?

A Of course, the discussion about Kinsella, as I understand it, resulted from the effort of engineers to work out a scheme to take care of distress gas. If development proceeds no doubt we are going to have a great deal of distress gas.

Q Yes?

A And if you have distress gas you have got to do something about it.

Q Yes?

A Now, whether Kinsella would be the proper field, or whether

some other field would be able to be developed, I do not know. No one else does either.

Q It is a problem?

A They may be storage fields, they may be used for storage purposes in the limited sense of the word, or they may be used similarly to Bow Island, and I cannot tell. I do not know, I am not an engineer.

Q But I mean Kinsella gives you a proper means for that process?

A Yes.

Q And do you know we are suffering from discrepancy im prices in the south now as the result of things that we won't go into at the moment, and we are a little tender about any further discrepancies,and we hate to visualize the situation....

A I certainly sympathize with you.

Q That the areas tributary taking care of peak loads in the north possibly will increase the prices here, and you will agree with me, in any event, that any scheme of that kind, or any other kind of scheme,involving the shuttling of gas back and forth as the result of increased costs, or as the result of supplying the peak load for Edmonton, I mean, that there should be some protection for those in the south, whether it is a differential or whether adding a certain cost with regard to export,that should be done.

A Yes. Mr. Fenerty, when you and I are through with this picture, there will be problems like that every day. They will go on forever. We are not going to solve them.

Q We are down to 6 cents now, and I do not want to get them to 12 cents, and you want to help me, do you?

A Yes, I do.

Q You do?

A Yes.

Q Thank you.

....

CROSS-EXAMINATION BY MR. NOLAN:

Q Mr. Milner, we have been discouraged from going into the question of ownership and control of our respective companies, but I wish you would tell me, or I wish you would let me read this paragraph to you from Exhibit J-13, the submission put in by Mr.Dixon the other day, and perhaps you have not had an opportunity of reading it?

A I would not have missed reading it for anything.

Q "Alberta Inter-Field Gas Lines Limited".....

MR. MAHAFFY: What page?

MR. NOLAN: Page 26.

Q "Alberta Inter-Field Gas Lines Limited is owned to the extent of approximately 99% by two subsidiaries of International Utilities Corporation; the Edmonton company, Northwestern Utilities, Limited, and the Calgary Company, Canadian Western Natural Gas Company Limited; Colonel L. D. M. Baxter of Winnipeg, Manitoba; Nesbit, Thomson & Company Limited of Montreal, Quebec; and Wood Gundy & Company, Limited,of Toronto, Ontario. " Is that a correct statement, Mr. Milner?

A It is a correct statement at the present time, but you must realize that in these Canadian companies we have to go to Canadian bankers because the companies haven't got the money of Morgan Stanley behind them.

Q No, but that is the pity. Well, Mr.Milner, there were one or two points arising out of your submission which I wish you would discuss with me just for a moment, if you will, please?

A Yes

Q At many places in your Exhibit J-26, you make mention of the fact that the Alberta Inter-Field would be under Provincial control, and under the jurisdiction of the Provincial authorities, and that is emphasized, may I say, and referred to a number of times. It is equally true, is it not, Mr. Milner, that any other gas gathering system would be under the jurisdiction of the Province?

A No, not your company.

Q I beg your pardon?

A Not your company, no. Not your grid company. It would undoubtedly be under the control of the Transport Board.

Q The grid company?

A Yes.

Q The Alberta Grid Company?

A That is my opinion.

Q And you are a lawyer, Mr. Milner?

A I am, still am.

Q You are a Doctor of Laws, Mr. Milner, and forgive me for not calling you Doctor?

A There is some error there.

Q But quite seriously.....

A Only the geologists in this game can be called doctors.

Q Quite seriously you do suggest that the Alberta Natural Gas Grid would be under the control of the Transport Commissioners, the Board of Transport Commissioners?

A I would think so on analogy with the railway situation, that a subsidiary company of a company operating under the Board of Transport Commissioners would also be subject to the jurisdiction of the Board.

Q Even though its operation is intra-Provincial?

A Even though it had a few Alberta shareholders.

Q Even though its operation is intra-Provincial?

A Yes, absolutely.

Q About that you and I disagree

A I defer to eminent counsel.

Q Now, Mr. Milner, on Page 6 you make mention of the fact that the proposed system would eliminate expensive duplication - it is the heading Number 7?

A Yes.

Q "To eliminate as far as possible and to the extent that present knowledge will permit, all expensive duplication of gas gathering lines and distribution systems."

A Yes.

Q Well, is it not fair to say that expensive duplication would be limited or eliminated by the activities of the Provincial authorities?

A I would not think so, Mr. Nolan. I would think that any transporting company could get permission, and any exporting company could get permission from the Board of Transport Commissioners subject to its discretion to build lines anywhere that it asked for.

Q Do you mean that all engineering practice would be thrown out of the window?

A It might very well be.

Q I beg your pardon?

A If they got the needed gas it might very well be.

Q What do you mean by that?

A Three export companies might build into the same field.

Q Well, would that be permitted?

A It has been permitted in Texas.

Q Oh, yes, but we have learned a lot from what happened in Texas.

A Who has?

Q We have, the Northwest Company. I was going to ask just this, Mr. Milner, on page 7 you say at the bottom of page 7,

> "It therefore follows that the gas gathering system should be constructed and operated by a company of the nature of Alberta Inter-Field and that adequate provision should be made to effectively prevent the control of such company passing into the hands of operators of an inter-provincial pipe line."

What is that adequate provision to which you are making reference? The restriction on the Class B?

A The Class B shares carry as far as reasonably can be done at the moment. The Class B shares provide that the control of the company shall certainly remain in Canadian hands.

Q Yes. And it equally provides in paragraph 4 of Section (b), as set out in the middle of page 9 of your submission, that the rights and restrictioms attaching to these shares may be altered by a majority of the Class B shareholders.....

A Yes.

Q .....comprising 75%?

A The majority of the shareholders in number and 75% in interest.

Q Yes. I was going to ask you one thing more about your submission. Just at the end of the paragraph, the last paragraph, five lines from the bottom.

A Which paragraph is that?

Q Just the very last on Page 10,- six lines from the bottom,

> "Neither the service nor the rates would have been so satisfactory if competing gas utilities had been permitted to serve those areas."

You are not suggesting, Mr. Milner, that my company or any of the other applicants have any plans to disturb your existing system in Calgary or Edmonton?

A No, not at all.

MR. C. E. SMITH: You should have said "disturb his monopoly".

MR. FENERTY: Disturb anything.

Q MR. NOLAN: Mr. Milner, you gave evidence before the Dinning Commission and presented a brief dated January 16th, 1949, you remember the occasion and perhaps you remember what you said in your brief?

A I remember the occasion but certainly not what I said in my brief.

Q Perhaps I might just help you for a moment. You are discussing the question of negotiating with Imperial Oil to satisfy your requirements, and you say,

> "Throughout the discussions about export, both before and since the appointment of this Commission, we have felt that our first duty is

"to protect the interests of our thousands of customers, and in so doing to protect the interests of other consumers in the Province and those who may be consumers in the future. Our objective was, and still is, an assurance to them of adequate supplies of gas for many years at reasonable prices.

In the course of talks in New York early this month with representatives of the export company, various possibilities were discussed which I believe should go a long way towards the maintenance of that objective in the event that the export of natural gas from Alberta is permitted."

That is leading up to what I really wanted to ask you, Mr. Milner, but I wanted to refresh your memory about the matters which you were discussing then. Now, this is what you say,-

"Briefly, it has been proposed that the Edmonton and Calgary Companies should construct and operate, and either own or have a dominating interest in, an Alberta pipe line system which would be used not only for export purposes but to reinforce the supplies to various Alberta communities."

You remember saying that, Mr. Milner?

A Very well, yes.

Q That is still your idea, Mr. Milner?

A No.

Q Do you now intend or want these two gas companies of Calgary and Edmonton to enjoy a dominating interest in the

Alberta pipe line system?

A No, I have long since come to the conclusion that that was impractical and that this gathering system should be owned, should be independent of both export and the internal companies.

Q That, of course, brings up the question of ownership and control, which I am not going to go into. Thank you.

A Do not hesitate if you would like to.

.....

CROSS-EXAMINATION BY MR. McDONALD:

Q Just one question, sir. I was interested in your statement on Page 3,"For example,a national or continental policy of dispersal or decentralization of industry might very easily result in building up very heavy industrial gas requirements in Alberta.". Now, it is your view if industry comes to Alberta such industry will be prepared to pay for gas at a price which includes the cost of acquiring the leases for the land, exploration thereof, the cost of drilling the wells, the cost of operation and a fair return to whoever puts up the money?

A It depends how much that amounts to. It depends how you convert X into cents.

Q Yes. I suggest to you that any customer of the Gas Company in the first analysis should be prepared to get the gas at what it costs?

A Yes,

Q And that heavy industry should be prepared, at least,

in the first place, should be prepared to pay that amount of money. The reason I mention this is that after discussing this matter with Mr. Donald the other day, that what he had in mind was that heavy industry would have to come to Alberta and would have to get here what you have described as distress gas. In other words, that is the gas available from the oil fields which the producers of the gas have to get rid of in order to produce the oil. Is that the type of heavy industry that you are referring to?

A No, I cannot say that I ever have thought particularly of heavy industry.

Q Or any industry?

A Although if there is any dispersal of industry in Canada, you might get some heavy industry here. That, Mr. McDonald, in my opinion, is something that no one can foresee yet.

Q What I had in mind there was, if this industry did come to Alberta and had to purchase that type of gas, that is, this distress gas, which is now being sold at much less than it cost to produce, and is sold only solely because of the production of oil, and I refer to Turner Valley and Leduc, then that gas will not be available for Alberta consumers as it is now, and, therefore, as I take it, the Alberta consumers would have to go out and drill their own gas wells like any other consumer of gas, or producer of gas?

A I do not know that I quite follow the point. If industry comes here it will be based in, it will have to consider first the fuel it is going to use, what it is going to

pay for that fuel, and how reliable that fuel is as to the time period.

Q Yes?

A Now, no one in his senses is going to come here and assume that they are going to live on distress gas. As I said a little while ago, the price of gas all over the Continent is going up and it will go up in Alberta the same as everywhere else.

Q If you get away from distress gas, then you are back to what the gas actually costs?

A Yes, certainly.

Q I was interested in that, in discussing the Kinsella field, in the discussion of the Kinsella field by Mr. Davis.

A Mr. who?

Q Mr. Davis?

A Yes.

Q He used the figure of 4½ cents as the value of the gas, or 5 cents, and I think he indicated that was on the margin of whether the - the margin of price at which the gas could be successfully developed as a paying proposition in that field. I think he went further, I think he went further and said that if he was going to recommend the investment in that field, as a new venture, I took it, that he would indicate to his financial friends, people who were going to invest money, that they should get 10 cents a thousand for gas?

A I would think that that gas on the basis of what is paid for other gas, that gas should be certainly worth 10 cents.

Q Yes?

A Of course, it does not cost anything as much to produce it as in some other fields. I wouldn't worry about the price of gas being too low.

Q I am not worrying about the price of gas, I am indicating that somebody some time has got to go out and get gas for Edmonton and Calgary at higher prices?

A They certainly have.

Q Than now?

A Than now.

Q You will agree with me?

A I will agree with you, yes.

(Go to Page 717)

Q Is not gas production a matter of the quantity handled and gas costs are almost directly related to the quantity handled?

A Oh, I do not agree with that at all.

Q Perhaps I did not understand you, Mr. Milner? The more gas that is available for distribution, either through export or to local consumers, the chances are the prices will be less rather than more.

A If you are saying the more gas and the smaller the market the cheaper the gas, I will agree with that. I thought you said that the more gas which was produced the more expensive it would be.

Q No, the reverse?

A No.

Q The more gas that is available or could be made available in the Province, the chances are the prices will be less?

A That all depends on the market. If you have a limited... market and a big supply the price is going down. If you have an unlimited market and a small supply, the price is going up.

Q So that regardless of whether there is export or not, there is a chance of a change in the price of gas to consumers?

A Yes.

EXAMINATION BY MR. C. E. SMITH:

Q Could I ask one question? Probably you will agree with me, Mr. Milner, that if the price to the consumer in Alberta is going to go up, it might go up less with export than without it. That is quite a possibility if not a probability?

A Go up less with export?

Q Yes?

A I would not think so.

Q Do you think export itself of necessity will result in a higher price to Alberta consumers? Some of them are frightened of this. I do not think that is so, do you?

A I do not know. It all depends on a lot of unknown quantities. It depends on how much gas you export.

Q Yes?

A It depends on where you have to take it from. It depends on whether additional gas is found. It depends on priorities as to supply and price that the local companies receive.

Q You sound like one of these geologists or engineers?

A Perhaps I am entitled to that doctor's degree after all.

Q What I am getting at is this, does export in itself mean a higher price to the local consumer? I grant you have all these things you talk about.

A It depends on the value of the gas, of the export gas, and the market where it is being sold.

Q Mr. Milner, my wife tells me that the price of gas to her cook stove is going to go up if they grant an export permit. Now that is as frank and as crude as I can get it to you. Is she right? A lot of people are worried about it.

A Yes, I would think she is.

Q You think export will put the price up under any circumstances?

A I think so. It will certainly have a tendency that way. How high that will be I do not know but it will be the

tendency. And I think you had better tell your wife she is paying too little anyhow.

Q I will be frank and tell her that but it is going up anyhow, and she does not like to believe me. Now with respect to Inter-Field and its planning, insofar as marketable reserves are concerned, do I understand Inter-Field accepts the submission with respect to marketable reserves as given by Dr. Nauss? I have particular reference to Exhibit 70.

A No, we have not been interested in the different estimates because to be quite frank, the spread is too great for our liking.

Q Probably you have forgotten that you did recite on page 3, at least your engineers did - -

A Oh, yes.

Q - - from Dr. Nauss' figures and that is in your Table headed "Gas fields - Alberta. Alberta Inter-Field Gas Lines Limited as listed by Dr. A. W. Nauss." Now, I wonder if you accepted his figures?

A No. Engineers have to have some sort of figures to base their work on.

Q They took the biggest figures we have had yet?

A Yes.

Q That does not mean you want the Board to think you are accepting them as your estimates?

A Not at all.

Q I wondered if that was so, because it might seem so from this. Now does religious persuasion or political leanings have anything to do with what the Board should do?

A How do you mean?

Q You did not tell us whether your directors were Conservatives or Liberals or Methodists or Roman Catholics?

A I, since a year ago last June, my tastes have become very catholic so far as politics are concerned.

CROSS-EXAMINATION BY MR. FENERTY:

Q I wonder if I could ask Mr. Milner one or two more questions on the point brought up by Mr. Smith. Mr. Smith was inviting you to give an opinion as to the possibility of the price going up as a result of export. I assume he meant if there is no specific protection afforded by the Board with reference to prices. But I want you to consider something which bears out what you said that there was a danger of it going up. You will remember, I believe, prior to 1944 and in 1944 the Canadian Western had a price at its gate under contract of 7¾ cents. You will remember that that agreement was abrogated by legislation and at successive rate hearings my friend Mr. McDonald was very successful in his application, there being then no protection to the Canadian Western either as to reserves and price, that prices went up successively to 9 cents, 10¾ cents in two hearings. Then as a result of Canadian Western's application before the Utilities Board the rates were increased to the consumers. I do not know whether you are aware or not, but in some hearings we had submitted to us specimen contracts and schedules of prices which were going to be paid by exporters, which in our computation would result in a price for clean scrubbed gas, a maximum price, clean scrubbed gas,

equivalent to 18 cents at the Canadian Western gate?

A I do not think that is what it would work out to.

Q Assume I am correct in that and assume that my friend Mr. McDonald's applications were perhaps correct in some ways that when the protection of the contract was taken away from local consumers the thing was competitive, we had long inquiries where coal was said to be competitive. I invite you to consider the position that if gas should be competitive, as they said before the Utilities Board, and if there is no protection and it is to be 18 cent gas, what will that do to the consumer in Southern Alberta?

A Certainly it would cost them a lot more money.

Q Whether the gas is sold on a competitive basis or not?

A Bound to.

EXAMINATION BY MR. MAHAFFY:

Q Just one question in connection with the point raised by my learned friend Mr. C. E. Smith. In the last paragraph of Exhibit 69 in the Westcoast case you said this:

> "We have made no comment in this report as to whether the gas reserves of the Province are sufficiently large to justify export. That is a matter which, in view of the declaration of policy made by responsible ministers, we are more than prepared to leave to the discretion of this Board and of the Provincial Government."

Is that still your position?

A That is still our position.

CROSS-EXAMINATION BY MR. McLAWS:

Q On this question of price, if the export of gas was from the Pincher Creek field alone should that result in any increase in price of gas in Calgary or in Edmonton, at the present time?

A It would have a tendency to. It might have a tendency to establish a higher price throughout the Province. That depends on a great many factors. It depends on whether the Pincher Creek gas is required or is likely to be required in the Province in a reasonably short time.

Q But until it is required it would not have any bearing on the domestic price?

A Not immediately, no.

EXAMINATION BY DR. GOVIER:

Q I have one question I wanted to ask you. In connection with your Item 2 on page 6, which reads:

> "To eliminate as far as possible and to the extent that present knowledge will permit, all expensive duplication of gas gathering lines and distribution systems."

Would it be the intent of Alberta Inter-Field to acquire the gathering systens which are now attached to the Calgary and Edmonton companies?

A No.

Q Could the intent of Item 7 be fully carried out, if the ownership of the gathering systems into the Calgary and Edmonton systems were different than the rest of the gathering systems in the Province?

A

A I am not sure I get that point.

Q The point is this, do you think it would be possible to avoid duplication and to ensure the orderly development of the gathering facilities in the Province if on the one hand the Gas companies own and operate the gathering facilities as they now do and on the other hand the Alberta Inter-Field were to own some projected lines?

A Well, it would be a matter of integration, of course. It could no doubt be worked out. But that matter - these companies are all set up now. I mean the present distributing companies. They have their capital set up. They have their bonds outstanding. Everything has been approved by the Public Utilities Board and to divest them of such fields as they own and the gathering systems in those fields might be a matter of great difficulty.

Q This would not involve the divesting of the systems?

A It is merely a matter of integration of Inter-Field and the existing distributing companies, it could be done.

Q You see no difficulty in integrating and getting a properly planned development even though the ownership would be divided?

A No, not at all.

Q THE CHAIRMAN: Is it the intention of Alberta Inter-Field to build any processing plants at all in these oil fields that you have mentioned specifically?

A That would be a matter that would have to be dealt with in each particular case. Of course in some fields you will find producers wanting to build their own facilities. In other fields they want to sell the gas at the well head.

And then you have to come down to the problem of how you are going to get your gas to a uniformity. That has to be done somewhere and someway by Inter-Field. You cannot be pushing different BTUs through the line all the time.

Q Would Inter-Field be prepared to build any gas processing plants?

A Yes.

Q Thank you.

(At this stage there was a short adjournment.)

MR. R. L. FENERTY: Mr. Chairman, I am appearing for Canadian Gulf Oil Company which wishes to make a submission as to estimated available reserves of gas in the Pincher Creek field. I would like to call Mr. Lloyd Gray to present the submission.

THE CHAIRMAN: Has Mr. Gray got a written submission?

MR. FENERTY: Yes, the Board has the submission and some counsel have it but I have not perhaps a sufficient number of copies. I have four additional copies that can be distributed.

LLOYD L. GRAY, having been duly sworn, examined by Mr. R. L. Fenerty, testified as follows:

MR. GRAY'S SUBMISSION NOW MARKED EXHIBIT J-27.

Q Mr. Gray, you have been sworn?

A Yes.

Q What is your present residence?

A Tulsa, Oklahoma.

Q Occupation?

A Chief Engineer for the Gulf Oil Corporation, Tulsa Division.

Q I believe you hold the degree of Bachelor of Science in Mechanical Engineering and also Bachelor of Science in Petroleum Engineering from the University of Oklahoma?

A That is right.

THE CHAIRMAN: Mr. Fenerty, the Board knows Mr. Gray.

MR. FENERTY: And you are satisfied as to his qualifications?

THE CHAIRMAN: Yes.

Q MR. FENERTY: Mr. Gray, you have prepared or have caused to be prepared a report on the available estimated reserves of gas in the Pincher Creek field?

A That is right.

Q Would you kindly read the report to the Board with such comments as you may consider necessary?

A INTRODUCTION

Canadian Gulf Oil Company wishes to express its appreciation for the opportunity to appear before the Board and present a submission and hopes the information it presents will prove to be of interest.

Canadian Gulf's only large gas reserve is located in the Pincher Creek Pool, Townships 3 and 4, Range 29W-4 - -

Q MR. C. E. SMITH: Is that 26 or 29?

A 29, West of the 4th Meridian.

- - and, therefore, this submission is restricted to that pool. Canadian Gulf is interested in obtaining an adequate

market for its Pincher Creek gas which will permit the economic development of this large source of supply which lies a depth of more than two miles below the surface.

Studies show that: (1) The Pincher Creek Madison Lime Pool contains 1.56 trillion cubic feet of producible gas: (2) taking into consideration all of the practical and technical factors, including conservation, economics, and productivity, Pincher Creek gas can be produced at a rate of 165 million cubic feet per day for more than 20 years, and (3) in spite of the many problems connected with the production of this gas, including the great depths of wells, corrosiveness of gas, and the formation of hydrates at existing high pressure, gas has been produced at commercial rates with back pressures in excess of 3,000 psi and Canadian Gulf has no doubt that this gas can be produced at practically any reasonable desired rate; (4) cycling operations in this pool are not economically feasible nor a conservation measure.

RESERVES

Canadian Gulf Oil Company has drilled three wells on the Pincher Creek structure. Two of these wells, the Pincher Creek No. 1 and the Walter Marr No. 1, are large wells producing from the Madison limestone at a depth of approximately 12,000 feet. The third well, the Schrempp No. 1, was intentionally drilled low on that structure as indicated by seismic data for the purpose of determining whether or not there is a liquid hydrocarbon phase present in the reservoir. Due to the fact that the uppermost zone

of the Madison limestone was apparently not fractured to the same degree as was encountered in the Walter Marr No. 1, and the Pincher Creek No. 1, and since the porosity occurred below the gas-water contact, this well was not productive in commercial quantities and, therefore, has been temporarily abandoned.

Practically the entire productive section of the Madison limestone in the Pincher Creek No. 1 and the Walter Marr No. 1 was cored. On the basis of the information obtained from these two wells, which are approximately seven miles apart, it is indicated that the total productive section of the Madison limestone in the Pincher Creek reservoir has a maximum thickness of 600 feet. Tests conducted on the three wells drilled on the Pincher Creek structure indicate the gas-water contact to be at approximately -8200 feet subsea. The fact that the three wells which have been drilled on the structure encountered the top of the Madison limestone at approximately the depth predicted from the seismograph information leads to the conclusion that the structure of the reservoir as delineated by the seismograph is reasonably reliable. Therefore, on the basis of seismograph data and the above indicated gas-water contact, the areal extent of the Pincher Creek field is estimated to be approximately 17,250 acres, as shown on the attached map, marked Exhibit A.

As mentioned previously, both the Pincher Creek No. 1 and the Walter Marr No. 1 were cored through the productive zones. A comparison of the core analyses of

these two wells indicates a remarkably close agreement on the total void space. Analysis of plugs obtained from the cores indicates an average porosity for the section cored of 3.5% in the case of the Pincher Creek No. 1 as compared to 4.1% in the case of the Walter Marr No. 1. Taking into consideration the measured permeability and furthermore on the basis of a detailed geologic microscopic examination of the core, the total net effective average porosity of the wells is estimated to be 2.5% and 2.9% for the Pincher Creek No. 1 and the Walter Marr No. 1, respectively. Employing the average effective porosity of the various lithologic members of the Madison limestone and taking into account the area wherein these members occur above the gas-water contact, and furthermore assuming an average connate water saturation of 20%, the total effective pore volume in the reservoir containing gas is estimated to be approximately 141,142 acre-feet.

The measured reservoir pressure of the Pincher Creek Field is 4,930 psi at -8097 feet subsea.

MR. FENERTY: That should be 79 not 97. I think that should be corrected, 79. I think that is a typographical error.

A The formation temperature is 191 degrees Fahrenheit. Employing these factors in conjunction with the above-mentioned effective pore volume of the reservoir and the "compressibility factor" of the reservoir fluid as observed in the laboratory investigations, the total estimated reserves in the Pincher Creek reservoir, assuming a

depletion pressure of 100 psi, is 1.65 trillion standard cubic feet of high pressure separator gas. (Gas measured at 14.4 psia. and 60 degrees Fahrenheit.) This reserve figure employing an assumed depletion pressure of 100 psi is presented as a matter of comparison with the estimates of the reserves of the field as presented by other sources. Taking a more conservative view, and assuming a depletion pressure of 400 psi, the estimated reserves for the field amount to 1.56 trillion cubic feet of gas.

Both of the above mentioned reserve figures are gross reserves. Fractional analyses have indicated that approximately 16% of the reservoir gas is composed of hydrogen sulphide and carbon dioxide. Taking this into consideration and assuming that after treating and allowing for reasonable line losses, 80% of the gross gas will be available for marketing, the estimated reserves for the field amount to 1.32 and 1.25 trillion standard cubic feet of high pressure separator gas for assumed depletion pressures of 100 psi and 400 psi, respectively.

DELIVERABILITY

Deliverability is the volume of gas which a well or wells can produce against an established pressure.

As mentioned previously, both the Pincher Creek No. 1 and the Walter Marr No. 1 are large wells. The attached table, Exhibit B, is a summary of the production test data of these two wells. As shown on the table, the Pincher Creek No. 1 produced at a maximum rate of 13.926 million cubic feet of gas per day with a tubing

pressure of 1350 pounds at the time of the initial tests in March 1948. In September 1948 after considerably more productive section has been penetrated, tests indicated a lower productivity than revealed in the March test. However, this was due to the fact that casing had been cemented through the formation and had not been adequately perforated at the time of the September test. When adequate perforations are made and the well acidized, it will show a productivity comparable to Marr #1. There is no market and up to now no incentive for spending the money to re-perforate and acidize.

The Walter Marr No. 1 produced at a rate of 10.326 million cubic feet of gas per day against a tubing pressure of 2903 psi. This and the other tests conducted during August of 1949 indicate this well to have an extremely high productivity. The great similarity between the two wells (the geologic section and the capacity), together with the fact that the two wells are seven miles apart, indicates notable uniformity throughout the reservoir and facilitates estimates of content and performance in which confidence can be placed.

As previously stated the Pincher Creek Pool can be produced at a rate of 165 million cubic feet of gas daily for over 20 years. This is not a limiting rate, however. The rate the field can be produced is largely a function of the number of wells and of the time it is desired to maintain a specific sustained rate. At a lower rate the time will be extended and if the rate is doubled

the time will be reduced.

Q I believe you have some further comments on this average porosity?

A Yes. In the report to the Dinning Commission, I believe it was in 1948, it was shown that Pincher Creek No. 1, between the depths of 11,760 and 12,202 feet, it was approximately 3%. Now, since then we have gone over the cores more carefully and also have taken in the full section - the section included in the Dinning Commission report does not constitute the full section - and after going over it further, we have reduced that porosity in our present estimate to 2½% from 3%.

Q One other point, referring back to page 2 of your report, at the foot of the page, I think perhaps this should be commented on that the extent of the area has a great effect on the reserves of the area from which this anticipated gas may be produced?

A That is right.

Q That is a major item in the calculation or one of the major items and I merely want to stress this point that the fact that this area is very definitely limited, or very definitely extended to certain areas is based on the fact that the log of your three wells closely corresponds with your seismic picture?

A That is correct.

Q And gives a great deal of confidence in the seismic picture that is presented as an exhibit to this report?

A That is right.

Q Defining the area for gas production?

A That is right.

MR. McDONALD: I wonder if there is going to be any statement with regard to the Stettler field?

MR. FENERTY: No submission is being presented with respect to the Stettler field.

EXAMINATION BY MR. C. E. SMITH.

Q Mr. Gray, I just have seen this report of yours as you were reading it. If I remember correctly, various opinions have been given to the Board and amongst other things that seemed to vary was the question of the thickness. I notice you have a thickness of 600 feet. Am I right in that?

A That is the maximum thickness. Actually that is a little bit higher than the maximum. 572 feet, I believe, is the maximum thickness encountered up to date.

Q When you say "maximum thickness", some of the witnesses have used a thickness of 572 to get their total reserves. You know what I mean?

A Yes.

Q Others have used, I think it is, 394, if I remember correctly?

A 394. I believe that forms - that our figure of 394 is the weighted average for the field taking into consideration the pinch-out to the water level.

Q I take it that would be the more proper figure to use in estimating the reserves, as these gentlemen have done, than the 572?

A I believe it would be more precise.

Q In estimating your reserves what figure did you use?

A 394.

Q 394. That would be the figure you used?

A Yes, sir.

Q I see in here you have a maximum thickness of 600 feet, so that is probably what I did not understand in connection with it. Now you have mentioned the Schrempp well, and which you say was on what you figured was the border of your field?

A Yes.

Q You mentioned that in passing. Can you give the Board a little more detail as to what occurred in connection with that well? Did you get any porosity thickness at all in that well?

A There was something in the neighbourhood of 100 feet of Madison lime above the gas-water contact. The section had some porosity, very low porosity, about 1%.

(Go to page 734.)

Q Is that what you call very tight?

A It has substantially no permeability. In other words, the formation there was not fractured to the same extent it was in Pincher Creek No.1 and Marr No.1.

Q You did not get production from there, did you?

A Not in commercial quantities.

Q Did you acidize, by the way?

A It was acidized on several occasions, yes.

Q Several occasions?

A Yes.

Q What do you mean by that, five, ten, three or six?

A I think it was three times, to the best of my recollection.

Q And I take it the reason you presently think you did not get production was because of the tighness of this formation?

A That is right.

Q When you say it was not fractured as those other wells were, a good deal of the production in the other wells is because of the fact you have found this fracturing with respect to them?

A In that section, yes.

Q And how far is that, or probably I can see from the map. All these wells are on this map attached, I think?

A Yes, three of them.

Q Indicated here. And the fact that you found about 100 feet of thickness there in this tight formation, would that disturb you at all with respect to what you found, if I may use the word, inside the field?

A In other areas?

Q That you might find the same situation in other wells, even well inside?

A The fact that Pincher Creek No.1 and Marr No.1 being seven miles apart and were very similar in characteristics it appeared that Schrempp No.1 in all probability was a local condition. On the other hand, if we entirely threw out that 100 foot section that we are talking about it probably would not change the reservoir pool more than about 10%. You see, that section only has about 1% porosity.

Q What I was wondering about, if you were, as Gulf, disturbed that you might find a similar tight condition in other places than within this field if you started putting other wells down? Understand what I mean?

A Yes.

Q I think Mr. Fenerty, in talking about Jumping Pound some months ago, called it barren spots.

A We think it is a local condition. There may be other areas you might have that local condition but two of the three produced from that section. Even if we used 10% it would be the maximum change in reserves as a result of throwing out that entire 100 foot section. Two-thirds of the wells to date have produced from it, so you would not want to shave the reserves more than 3% or 4%.

Q Unless you moved in a bit, so to speak, and found the same conditions as to tightness inside Schrempp?

A Yes.

Q That is merely a matter of discovery later on as to whether you might find that or not?

A We have not been much concerned about it for the reason about 10% would be the maximum and that is not substantial.

Q You think there is a possibility of finding between 1 and 2 a similar situation, in this 7-mile area?

A It is possible.

Q But I take it from your seismic studies and so on you do not anticipate that in any event?

A The seismic information would not tell you whether that particular zone was porous or permeable.

Q The only way you could find out with respect to that is to put a well down?

A Yes.

Q That is all I have at the moment.

EXAMINATION BY MR. R.L. FENERTY:

Q Perhaps I might ask one question to clear that up. With respect to the upper 100 foot zone in the Schrempp one, that is 100 feet above the water contact, the porosity is possibly 1%?

A That is right.

Q In the Walter Marr and Pincher Creek No.1 wells you have given the average. What was the porosity in the corresponding zones in the Walter Marr and Pincher Creek No.1 wells?

A Also about 1% but in both of those wells there was fracturing in there to give you communication.

Q So that there was approximately the same porosity but simply an absence of fracturing in this one location?

A Yes.

EXAMINATION BY DR. GOVIER:

Q Mr. Gray, I would like to take advantage of your presence here and ask you a number of detailed questions.

A I am not sure I can answer all the detailed questions. We have Mr. Wilkins here and he has carried on the reservoir tests.

Q On page 1 where you refer to the figure 1.56 trillion cubic feet of producible gas, that is raw gas?

A That is right.

Q And on the same page you say,

> "Pincher Creek gas can be produced at the rate of 165 million cubic feet per day for more than 20 years."

I take it that you arrived at that figure by assuming a certain per well figure in a certain number of wells, is that right?

A Yes, sir.

Q Can you give me the two figures involved in it?

A We have carried out some studies along that line. Assuming a projected rate of, say, 10 million cubic feet it would take about 18 wells in order to maintain the 165 million rate.

Q Does that mean that your present thinking is the fully developed pool might contain 18 wells and that each of those wells would have an initial legal allowable of near 10 million per day?

A We do not think of the 10 million as being a limiting amount. In the early stages of development I think it would be desirable to produce them at a higher rate than

10 million in order that you can arrive at your 165 before it took too long to drill those wells. Each one takes about a year to drill.

Q Tell me, Mr. Gray, how do you arrive at the 10 million figure or how did you arrive at whatever higher figure you would need actually in the life of the pool?

A There isn't any specific or precise way of arriving at the 10 million. The wells are extremely expensive and it will take something like 10 million to justify the drilling of wells to that depth, a cost of substantially a million dollars a piece.

Q I suppose also you refer to the tests which were made where you found it was possible to produce both Pincher Creek and Walter Marr at rates near 10 million, is that true?

A That is right.

Q What I was wondering was whether there was any relationship between the 10 million figure and the calculated absolute open flow figure which I imagine you were able to obtain from these similar tests?

A I believe on the open flow figure for Marr it was in the neighbourhood of 80 million feet, and for the Pincher Creek No.1 submitted tests I believe it was 45 million feet and that the entire section on Pincher Creek No.1 had not been penetrated at that time. I expect if you re-opened and re-acidized you would have somewhere near 100 million feet.

Q The Board has received evidence about the back pressure curves which I believe was supplied to one of the applicants by your company, and it is to those curves that you

are referring when you quote those figures, is it?

A That is right.

Q Would you care to discuss the possible reliability of that data or would you rather have Mr. Wilkin do it?

A I thought it would be better if Mr. Wilkin discussed that phase of it.

Q On page 1, near the bottom, you say that:

> "Canadian Gulf has no doubt that this gas can be produced at practically any reasonable desired rate."

Did you have any range of rates in mind?

A I think that without question they can produce that field up to 300 million cubic feet a day if it is desired to produce it at that rate.

Q 300 million would be your idea of a maximum, would it?

A It would depend on how large the pool was eventually determined to be. At the present time we think in the neighbourhood of 17,250 acres. It is entirely possible that it will be larger than that.

Q Would the 300 million be a figure that you would think of after 18 wells had been drilled?

A No. I believe it would take in the neighbourhood of 40 wells if you were going to get to the higher production rate.

Q Would it be possible to put 40 wells on one section spacing in that area?

A There are 27 sections, I believe, in there. It would not be quite one well to an section.

Q What is your present idea as to the number of wells which

it would be economically desirable to drill assuming a market for gas from Pincher Creek?

A I believe you would have to know a little bit about the rate at which it is going to be produced. I think there is a direct relation to the rate of production and the number of wells you drill.

Q Suppose we assume your figure of 10 million per day per well, on the basis of that assumption, what is your idea as to the economic number of wells to drill in the field?

A For 165 I think the proper amount would be 18 producing wells.

Q At the bottom of page 1 you refer under item 4 to "cycling operations in this pool are not economically feasible nor a conservation measure." Am I right in interpreting that as "nor necessary as a conservation measure"?

A The cycling operation would not be a conservation measure. I say that on the basis that the total B.T.U. content of any additional condensate in that amounts in the neighbourhood of 6 trillion B.T.U's. The fuel required to re-inject gas into the reservoir would amount to in the neighbourhood of 23 trillion B.T.U.'s. You are losing ground.

Q So it would be an anti-conservation measure. On page 2, Mr. Gray, at the bottom of the first paragraph, you say with reference to the Schrempp well,

"Has been temporarily abandoned."

Is there any significance to the word "temporarily"?

A We have not pulled the casing or plug.

Q Have you any plans for that well?

A I think there are possibilities that once we begin producing in that pool we may be able to do something in the upper portion of this Madison section.

Q In the portion where you have low permeability but above 1% porosity?

A That is right.

Q Were you thinking of shutting in or hydro-packing? At the bottom of page 2 you refer to the 17,250 acres. Is that the area at the gas-water contact?

A Yes, in accordance with the map that is submitted.

Q Was the gas-water contact established at both or at all three wells?

A No. In Pincher Creek No.1 we never did get a gas-water contact, we ran into black lime before we got to that point, as established in both the Schrempp and the Walter Marr.

Q Did you bottom Pincher Creek No.1 before the gas-water contact as established in Marr and Schrempp or did you go below it?

A We went to a total depth there of 12,516, I believe. I believe we bottomed before the minus 8200.

Q So you have no evidence of the continuity of the water?

A That is right.

Q But you expect that?

A Yes.

Q Mr. Gray, I do not know anything about seismic work at all. I was wondering whether you could tell me if the seismic picture would indicate whether or not there was any possibility of faulting within the area you have delineated?

L. L. Gray,
Exam. by Dr. Govier.

A I am not any specialist on geophysics. The picture as I see it showed a number of faults throughout that structure. There is an indication of those faults at that point. It may be a barrier, it may be the end of the structure. On the other hand, there isn't anything definite to say it would not go on further. Now, there are several faults shown on the seismic picture, cross-faults, but none of them in my opinion would cause a barrier. In other words, it would be on either side of the fault and you could still produce.

Q Did any of those faults appears to have a throw approximating the thickness of the section?

A Not completely across. There was one of them indicated on the edge of the structure and it might be that great.

Q But it did not go across?

A It did not go across.

Q Does the seismic picture give pretty reliable information on faults?

A I think it gives fair information.

Q If there was a fault it would show up, would it?

A That is right. The Northeastern side of the pool is delineated by a major fault.

Q Which shows up clearly?

A That is right.

Q So that adding it all up, you feel although there may be faults within this delineated area they would either be of insufficient throw or they would not extend right across the pool, so you think this is definitely a continuous reservoir?

A I do.

Q I appreciate the fact, Mr. Gray, that a good deal of the permeability in this formation is through fracturing but did you run any permeability tests on cores?

A Yes, sir.

Q Is that information, in your opinion, at all indicative of the permeability of the field?

A The permeability of the cores?

Q Yes?

A I believe the field permeability will be greater than any information you would get from cores. In other words, you can not test a fracture, they will fall apart on any core analysis.

Q Could you indicate to us the range of the values you got on your core permeability tests?

A I believe that would be a question Mr. Wilkins would be much better qualified and prepared to answer than myself.

Q Incidentally, were those cores large or small cores?

A They were in the neighbourhood of 3½ inches in diameter.

Q What we would refer to as large cores?

A Yes.

Q On page 3 you refer to the assumption of an average connate water saturation of 20%. Does that mean that that was not measured in the laboratory?

A That is right.

Q Is 20% a value which is consistent with your experience in other fields, that are similar in effect to this one?

A Yes. Generally we also found that the limestone reservoir, dolomite reservoirs, have a lower connate water content than sand.

Q I suppose the fracturing would tend to show a lower figure too, would it?

A Yes, it would.

Q At the bottom of the first paragraph on page 3, you say:

> "The total effective pore volume in the reservoir containing gas is estimated to be approximately 141,142 acre feet."

Is that a figure obtained by planimetering?

A Yes, it was a planimetered measurement.

Q I take it that means that you drew up a isopachous map taking into account the data you had on the three wells on the seismic picture, which would reflect any fault?

A That is right. And that is the way we came back to the average thickness of 394 feet.

Q That was what I was going to ask. You then obtained 394 by dividing - - I would like to be sure I am right on this - - did you divide 141,142 by the area, which is 17,250, and by the average of 2.5% and 2.9%?

A I think that would be better answered by Mr. Wilkins. He actually made that calculation.

Q And then, of course, you would also have to divide by this connate water factor?

A Yes.

Q I will ask Mr. Wilkins about it. I believe, Mr. Gray, there has been a little bit of variance, it has been minor admittedly, in the reservoir pressure figures which have been submitted to the Board. Did you get different values in different wells?

A There was a slight difference. I do not recall what it was

but it was less than 100 pounds difference between the two wells.

Q The 4930 is your average figure, is it?

A Yes.

Q When you measured the compressibility factor in your laboratory was that measurement made on the whole gas, the whole fluid as it would exist in the reservoir, that is, did the gas contain the hydro-sulphide, the CO_2 and the condensate fluid itself?

A I am not sure whether it contained the condensate. It did contain the other constituents.

Q Do you happen to recall the compressibility factor you obtained there?

A Mr. Wilkins has that figure.

Q On page 4 you indicate that a deduction of approximately 16% should be made for CO_2 and H_2S, and then you say,

> "Taking this into consideration and assuming that after treating and allowing for reasonable line losses, 80% of the gross gas will be available for marketing,"

etc. Now, that means that you are allowing in addition to the 16%, 4% more to handle shrinkage due to removal of hudro-carbons, field fuel, plant fuel, and any operational loss. Am I right?

A Field requirements, you notice this states high pressure separator gas. We believe we will have enough fuel gas from our low pressure separator to take care of our field requirements.

Q But the low pressure separator gas will still have to

come from the same estimated reserve of 1.56, would it not, 1.56 trillion?

A I believe that 1.56 trillion took into consideration - - that is another question I think Mr. Wilkins should reply to.

Q I will ask Mr. Wilkins. Mr. Gray, have you ever heard of a rule-of-thumb that was offered to the Board just as a general guide, namely, that if you take the reserve of gas in place in the reservoir and divide it by 10,000 you get a figure which approximates the daily average rate at which that gas could be produced over a 20-year life? Do you know that rule-of-thumb at all?

A I never have used it. I never heard of it, even.

Q Well, there is no need of my asking you whether you think much of it. Well, in 20 years there are 7300 days, and that rule-of-thumb suggests that that figure should be increased to 10,000 to take into account the various factors, and then if you divided the reserve by 10,000 you should come out with a daily average rate for a 20-year period. The reason I wondered about it is if we take your reserve of, say, 132 or, I am sorry, 1.32 or 1.25 trillion cubic feet of pipe line gas, if you divided that by 10,000 we would end up with 132 or 125 million feet per day.

A That would be marketable gas and it would require substantially 165 million, a little over 150 million.

Q It takes it reasonably close to that, doesn't it? Anyway, you are not familiar with that rule-of-thumb?

A No.

Q You have never used it. Thanks very much.

MR. R.L. FENERTY: Would the Board like me to call Mr. Wilkins?

THE CHAIRMAN: Yes.

ROBERT B. WILKINS, having been first duly sworn, testified as follows:

MR. R.L. FENERTY: Mr. Chairman, would you like

Q me to qualify Mr. Wilkins?

THE CHAIRMAN: No.

MR. R.L. FENERTY: There will be no direct examination. Just answer the questions of the Board, please.

EXAMINATION BY DR. GOVIER:

Q Well, Mr. Wilkins, I guess you know the questions I would like to ask following my discussion with Mr. Gray. I think the first point was in connection with your laboratory measurements of permeability. Do you happen to have available figures indicating the laboratory test results?

A Yes, I have.

Q If you could just indicate to us the range of permeability and perhaps an average and that would be sufficient.

A When we measure the permeabilities, as you know we can not get a plug through a fracture and therefore what we measured was the consolidated portion of the plug and it had relatively low permeabilities. I think they averaged probably 3 millidarcies for the productive section, which is quite low. The total millidarcy feet in the Pincher Creek No.1,

as I recall, of the measured permeability from small plugs was on the order of a magnitude of 180 millidarcy feet, some such figure. I will check to make sure. In the case of Marr No.1 it measured 180 millidarcies, in the inter-granular system. In other words, on the small volume it was not taking into consideration flow tests which were conducted on that well. It was indicated that the total effective millidarcy feet in Marr No.1 was some 1860 millidarcy feet.

Q That figure was obtained by calculating backwards from the field tests?

A Yes, sir. It is an application of the rate of flow equation.

Q Does that indicate to you then that you are getting about 9 times as much permeability from the fractures as from the part of the reservoir rock which you were able to recover through cores?

A Yes.

Q Were the tests on Pincher Creek cores very similar to these?

A Yes, they were on the same order of magnitude.

Q Would you say, Mr. Wilkins, that even the 1800 millidarcy feet figure was indicative of a well with a large potential?

A I think it is indicative of a very large gas well, particularly at the pressures which we have in the Pincher Creek field.

Q Would you confirm my understanding of the average pay thickness figure of 394 feet, which Mr. Gray mentioned?

Was it obtained by dividing the 141,142 figure by the acreage figure and by the average of these two porosity figures of 2.5 and 2.9 per cent?

A It was not arrived at in exactly that manner but in effect that is what it is.

Q Is it equivalent to doing that? And taking the connate water into account, of course?

A I have not checked it from that angle. I might describe very briefly the way I went through that calculation.

Q Would you, please?

A The Pincher Creek structure is an anticlime and we assume a horizontal water table at approximately 8200 feet. Then the doming effect of the various zones as they disappear below the gas-water contact eliminates from consideration the zones as they go below the contact. Therefore, using the planimeter on the data from the seismograph information it was possible to estimate the average thickness and areal extent of each of the various litholitic members, and applying the effective porosity of the litholitic members to this average thickness and areal extent to each litholitic member you arrive at the total acre feet.

(Go to page 750)

Q Well, that procedure should be more reliable, I take it, than the mere application of the average effective porosity figure for the whole section?

A Yes, it could be.

Q Can you tell me anything about the compressibility factor of measurement, Mr. Wilkins?

A Yes.

Q Mr. Gray mentioned it was for the whole think, but he was not sure whether the condensate was included in it or not.

A The compressibility factor which was utilized was determined in the Gulf Research and Development Company laboratories in Pittsburgh, and it was a re-combinatiom to the effect that it was reservoir fluid which was being analyzed, and, as I recall the compressibility factor, formation temperature and pressure, it is .96 or .965, I do not recall which. It is .965, I believe. It does take into account the condensate.

Q The CO_2 and H_2S?

A Yes.

Q What about the deduction from the raw gas to get the available pipe line gas, can you indicate your thinking on that?

A I think we have indicated to the Board previously that we are not completely satisfied with the analysis of the reservoir fluid. It is quite corrosive. The first sample which was analyzed indicated approximately 16% acid gas, and the subsequent sample which was analyzed which was obtained at the same time as the first sample, indicated approximately .13 acid gas, 13% CO_2 and H_2S. We took with regard to the acid gas, it was packed in a

container, and the 13% is a lot lower than what has been set out, and we have been on the conservative side in reducing the volume, and we have assumed 16% acid gases.

Q What kind of containers were the samples taken in?

A The original samples were taken in a steel container.

Q Well, let us assume that the 16% figure is right, you have then made a further deduction of 4%. What items are calculated in that 4%?

A Just the - I have called them line losses. It is just a further matter of reducing the figure to the most conservative. At the high pressures which we have there we know we will have line losses. And it would not be presenting it with too much particularity if we did not take that into consideration. That may be abnormally high.

Q What about field fuel, possible plant fuel and plant shrinkage due to the removal of the liquid hydrocarbon?

A You are speaking of the gasoline plant and that type of thing?

Q Well, something of that sort would be required in producing this field, would it not, Mr. Wilkins? Some type of a separation plant?

A Not necessarily, I do not believe.

Q You think the field might be produced merely with the scrubbing plant, do you?

A I think that if we had a crude stabilization plant we could handle it very well. Whether it would be practicable to instal a gasoline plant is a matter of economics. I might point out to the Board that the C_6 plus in the analysis is relatively high as compared to the high

quantity of methane, which leaves a very relatively low concentration of the L.P.G. constituents in the reservoir fluid, consequently the recoveries which we would realize from the gasoline plant would be abnormally low as compared with other reservoir fluids with which I am familiar.

Q Tell me, is the 1.56 trillion cubic feet of gas which Mr. Gray presented, on the bottom of Page 3, is that gas in the reservoir, and does it include the volume that would be got with regard to the C_6 pluses?

A That is the high pressure separator gas and the condensate has been removed.

Q Has been removed?

A Yes.

Q What about field fuel and fuel for even say a scrubbimg plant, has there been any provision made, Mr.Wilkins, for those items?

A It has been my feeling that we would have sufficient fuel from the second and third stages of separation to provide adequate fuel for field use.

Q And the gas that would be evolved from the second and third stages of operation is not included in the 1.56?

A No, sir.

Q Would you care to give a little discourse on your views of the reliability of the back pressure tests which were conducted, Mr.Wilkins?

A Well, I think I am familiar with what you are bringing up, that is, the fact that the method which is ordinarily used as described in the U.S. Bureau of Mines Monograph Number 7 was outlined in 1933 at the time when wells were relatively shallow and pressures were low, and

pressures were low, and there may be some concern whether or not it is applicable to a very high pressure reservoir containing a retrograde condensate type of fluid; but it is an index of the capacity of a well to produce. The exact number, I think, is irrelevant. It does indicate in the case of Pincher Creek No. 1 and the Walter Marr No. 1, that we have tremendously big wells, bigger than anything we have encountered in our division in the United States.

Q Would you be at all concerned with regard to the possibility of there being a large error thrown into the interpretation of this test data through the uncertainties in calculating the flowing friction in the two miles of flow line?

A I think it is very possible, yes, to have a considerable error. I have played around with that a little bit by applying some corrections which are outlined in the 1948 A.P.I. Drilling and Production by, I think his name is Benson, I believe it is, and he describes the method of carrying out further refinements with regard to that method, and we got rather good agreement by using those refinements.

Q It did not change your final result significantly?

A That is applying the measured bottom hole pressures. You will note in one of these tests that have been submitted to you, we did have actual measured bottom hole pressures.

Q Oh, I did not realize that.

A I believe it is tabulated in there, but in that case we did get rather good agreement.

Q But you feel without even taking into account the diffi-

culties of interpreting data of this sort that it is fair enough to say that these are big wells.

A Yes. I think it is safe to say that they are tremendously big wells, and their indicated open flow capacity is just an index.

Q They might be anywhere from 40 to 100, something of that sort?

A That is right.

Q Do you agree with Mr. Gray - I am sure you will - do you agree with Mr. Gray that these wells can be operated at a daily average rate of around 10 million without any danger? Do you think that is a reasonable rate?

A I think it is a reasonable rate. I think that experience will tell. I think as far as the reservoir is concerned, it is capable and it probably will not harm the reservoir to produce at rates far in excess of that. Whether or not the equipment can withstand extremely high rates of production, I think we might be in a better position to tell after our pilot project is completed this summer.

Q Mr. Wilkins, if you were in the position of the Board and had to try to estimate the potential ability of the Pincher Creek field to meet peak day loads and so on, would you use a figure of about 10 per well?

A That, actually, was rather an arbitrary figure, but I think it is something of the right order of magnitude to be considered.

Q Do you think it is about as close as anyone could approximate the correct figures today?

A I do not think the higher rates will harm the reservoir.

Q Well, then, would you suggest that the Board might be

perfectly safe to use a higher figure, from 12 to 14, or maybe 12 or 14?

A Yes, sir, I think you would.

Q You think we would be safe?

A Yes, it is a matter of the producer really, whether or not he feels that he has the equipment that can take care of it, but as far as the reservoir is concerned, I think you are safe. I do not think - I think that our pilot project will tell us something of the equipment, so that we will be equipped to handle higher rates of production.

Q Then there is another matter, of course, that has a controlling influence on the amount of gas that can be put to market, and that is the capacity of the processing facilities. Perhaps I should have got Mr. Gray to answer this question, but maybe you could answer it for me, Mr. Wilkins, and that is, should the Board understand that Gulf are not only prepared to drill wells up to maybe 18 if there is a market outlet for them, but they are also prepared to erect any processing facilities that are necessary. To see that those facilities have a capacity sufficient to meet deliverability of, say, 165 a day? Maybe I have asked too many questions at once, have I?

A Well, in the first place, Gulf wants a market for its gas, and we would, I think, - maybe I am stepping out of my realm, but I am quite sure that they would be prepared to make the necessary investment to see that the demand was satisfied.

Q Would you rather that we asked that question of Mr.Gray?

A If you want a different answer than what I gave you.

Q I am not looking for a different answer, I just don't

want you, I just don't want to put you in an embarrassing position, that is all.

A Well, I have been embarrassed before so that it is all right.

Q One of the things that is concerning the Board is the fact that - no, I do not think I will ask you that question. I think your company has gone on record before somewhere as being in favour of the steady, of the production of this field at a steady rate, is that true? Or is that your opinion?

A Well, of course, that would involve having to drill fewer wells if we could depend on a uniform rate of production and not have to drill a sufficient number of wells to meet high peaks considerably above the average rate of production, so that would involve less investment probably.

Q It ends up as a matter of economics, does it?

A Yes.

Q And would you say that in a field where the cost of drilling wells is high, as it is in Pincher Creek, it is really very important from an economic viewpoint to try and provide a steady load for the field, would you go that far?

A It would be desirable.

Q Is it essential?

A A reasonable load factor could be taken care of.

Q 60%?

A I am not qualified to answer that. I was thinking of the order of 72 or 75.

Q 75, somewhere around there?

A Yes.

Q Those are all my questions, Mr. Wilkins. I would like

to say that I appreciate what you and Mr. Gray have made available to us today.

A Thank you.

THE CHAIRMAN: Mr. Smith, I do not know whether the Seaboard are represented by counsel or not.

MR. WILLIAMS: I am representing the Seaboard. This company is appearing here today pursuant to the request contained in your remarks of September last, and appearing as a non-interested party, neither opposing nor assisting anyone or anything in the present application. In our exploratory activities we have found some evidence of rather extensive gas fields in northern Alberta, in the Wabiskaw district, and Mr. Clark, our chief geologist in Canada, is here to give some of the technical aspects of that, simply in a measure to prove our statements to the Board.

(Go to Page 758)

LESLIE M. CLARK, having been duly sworn, examined by Mr. Williams, testified as follows:-

THE CHAIRMAN: The Seaboard submission will now be marked Exhibit J-28.

SUBMISSION, SEABOARD OIL COMPANY OF DELAWARE to JOINT HEARING OF PETROLEUM AND NATURAL GAS CONSERVATION BOARD IS NOW MARKED EXHIBIT J-28.

MR. WILLIAMS: I believe the Board is quite familiar with the reputation and position of Mr. Clark?

THE CHAIRMAN: Yes, we know.

THE WITNESS: I believe it is right that I should read this, seeing it is only three pages?

THE CHAIRMAN: Yes.

A Our knowledge of the subsurface geology of the Wabiskaw Area is largely derived from the results of two wells which we drilled in this area in the course of our exploration for oil, principally in the Devonian. These wells are known as Barnsdall West Wabiskaw #1, Lsd. 11, Section 17, Township 78, Range 2, West of the 5th Meridian and Barnsdall Pelican Lake #1, Lsd. 1, Section 27, Township 79, Range 22, West of the 4th Meridian, 37 miles apart. These wells incidentally are north and northeast of Lesser Slave Lake, a matter of 60 to 90 miles. Neither found commercial oil production, but both encountered gas in thick porous Lower Cretaceous sands. The gas from these sands flowed on drillstem tests at the approximate rates of 1500 and 1092 Mcf/day respectively and in view of the general experience in Alberta, it is believed that a production

test would result in potential flows of several times these figures.

Our regional geologic studies based on the surrounding wells located which are many miles apart, show the regional structure to be a gently southwestward dipping monocline with the Devonian beds dipping somewhat steeper than the unconformably overlying Lower Cretaceous. Our seismograph work corroborates this regional southwest dip but shows numerous minor irregularities and anomalies which may or may not be structural. Our regional geologic studies also show much better sand development throughout the Lower Cretaceous section in the Wabiskaw Area than is present in most of the nearest tests which are many miles distant.

Detailed study of the Cretaceous section in our two wells shows that on top of the Grand Rapids formation, (top of the Lower Cretaceous), Pelican Lake #1 is 215 feet higher than West Wabiskaw #1.

Q DR. GOVIER: Is that 215?

A 215 feet. This study also shows that a number of sand members separated by shales make up the Lower Cretaceous. All of these sands in our two wells are more or less stained with heavy tarry oil, as is also the upper part of the Devonian limestone.

As regards the Cretaceous gas sands, we are not certain that they exactly correlate, but in view of their similar positions in the section, their similar characters and relation to the Ostracod zone, it appears

reasonable to believe that they do correlate. This sand largely shales-out in an updip direction towards Bear Beaumont #1 in Lsd. 14, Section 25, Township 77, Range 18, West of the 4th Meridian. That, incidentally, is some 25 miles east of our most easterly well. In our West Wabiskaw #1, this gas sand was encountered at a depth of 1728 feet (elevation of 332 feet above sea level), while in the Pelican Lake #1 it was at a depth of 1306 feet (602 feet above sea level). In the former well, drillstem test of the interval 1720-1756, resulted in a flow of gas estimated at 1500 Mcf. and recovery of 90 feet of muddy water. Bottom Hole Pressure chart showed Flow Pressure of of 310# and Shut In Pressure of 420#. Although a little salt water came in with the gas, it appears that this was probably forced up from below the bottom of the hole, as the electrolog indicates the gas-water interface to occur in the midst of the sand body at 1770 feet. We feel quite safe in saying that there is at least a 30 foot gas column in the sand body, which from core analysis is shown to have porosity averaging 25% and permeability ranging from 578 to 4000 Millidarcies. In Pelican Lake #1, drillstem test of the gas sand, interval 1302-1335 feet, resulted in a measured gas flow of 1092 Mcf. daily rate, and recovery of 10 feet of drilling mud. Bottom Hole Pressure chart from this test showed Shut In Pressure of 330# and Flow Pressure of 240#. We have no electrolog of this part of this hole as it became necessary to run 7" casing hurriedly when circulation was lost in the top of the Devonian and gas

blow out threatened. However, from the cores it is known that this gas sand persisted as a continuous sand body to 1366 feet with gas showing in every core similar to the shows encountered in the part of the sand that was tested. It thus appears probable that the entire 60 foot sand body is gas saturated at this location. Lower sands and silty sands with some shale were cored to 1420 feet and these also showed gas when the cores were extracted. It thus appears that we are ultra-conservative in using a figure of 33 feet for the gas column in this well. Porosity of the gas sand ranges from 20 to 40% and permeability from nil to 4000 Millidarcies.

We have made the following calculation of our possible gas reserves in the Wabiskaw Area, using an average thickness of sand of 31 feet and assuming that only 200,000 acres of our 900,000-acre block is productive. This gives no consideration to the possibility that the gas column may be considerably thicker than the average of 31 feet obtained from the two wells. The data used for computing these possible gas reserves are:

Average thickness of sands	31 feet
Average porosity	29%
Average pressure	375#
Assumed abandonment pressure	100#
Estimated connate water	15%

$$\text{Volume} = 200{,}000 \times 31 \times .29 \times .85 \times 43{,}560 \times \frac{275 + 14.4}{14.4} =$$

1.336 trillion cubic feet.

We have not, in making this calculation, attempted to carry out some of the refinements that one could when you have larger detailed information. There is not much

use in carrying out something here to 6 or 7 places or using factors such as a correction for temperature, which we estimate as the average temperature as about 59% when we are using the estimated factor of the number of acres that is possibly productive. I wish to explain that, that we have not carried out to ridiculous extremes with some factors when we had such a leeway in others. Now this area or that number of sections, that 200,000 acres, would make a strip of land approximately 9 miles wide and comprising the entire area between those two wells.

MR. WILLIAMS: That was all we wished to submit directly, sir. The question of developing this area, the future development, will have to be left in abeyance at the present time pending other matters which are not being brought before this Board at this time. We endeavoured to assist the Board in advising them of the fact there was this possible gas reserve and the possible extent of it. But the work done on it, of course, with the data is very limited.

EXAMINATION BY MR. C. E. SMITH:

Q I did not quite follow the geography. Where did you say this field was located?

A It is north and northeast of Lesser Slave Lake. It is north of Edmonton. It is 160 miles or thereabouts north of Edmonton. That is the general area.

Q How did you get in, Mr. Clark, did you build your own road?

A Yes. There was a trail, a wagon road in there. There is quite a settlement in there. Two missions, a Catholic and

an Anglican mission and probably 1200 to 1500 Indians in that general area. They had a wagon road out originally but we bulldozed a better road in there.

Q How far did you have to do that, roughly?

A To the middle of the area, about 90 miles.

Q Just one other thing. I do not know whether I followed you with respect to the acreage. I realize what you have said and how you "guesstimated" that, if I might use that word. But you say there is a nine mile strip between the two wells?

A No, we have estimated 200,000 acres. We have two wells 37 miles apart and the 200,000 acres of estimated productivity would make a nine mile strip of land from the one well to the other.

Q I see. And you have just taken that because you want to arrive at a figure of some kind?

A Yes. I feel that drilling the two wells here as these are, more or less haphazardly, we have done some seismic work so it is not quite haphazardly - but due to the short season during which we can work in that area we were limited in the amount of work we could do before we made location, and the drilling of these two wells 37 miles apart and encountering that sand, they seemed to correlate and it seems to be the same sand, having approximately the same thickness in both cases, a good thick sand, perhaps lithologically similar, we felt there was a fair chance that if at least this sand was not a continuous body between them, at least our having encountered it in two wells that far apart would suggest a likelihood that there was an extensive

development of this sand, even if at places it might pinch out or thin down.

Q And I anticipate that you will get a big shock if you see in some paper a large headline that there is 1 trillion 300 billion cubic feet of gas 90 miles from Slave Lake?

A No, it won't bother me any.

Q It might bother a lot of people who read the newspapers, that is all I am getting at.

THE CHAIRMAN: Are there any other independent companies or representatives of independent companies just now who would like to make any submissions to the Board?

MR. C. E. SMITH: Was this submission numbered, of Mr. Clark's?

THE CHAIRMAN: Yes, J-28.

MR. C. E. SMITH: I have received some information about other people in a similar capacity, I would say, to Seaboard, both by way of companies and maybe individuals, who desire on their part to say something similar, I take it, to the Board, but apparently they had the idea, from what I have learned, that tomorrow morning would be the proper time, as the Board is going to be tied up today. That is some information I received during the recess. What I have in mind is it might be well for the Board to consider their schedule tomorrow, if that occurs. I may say that I had arranged, in view of what was said yesterday, I had arranged with both Mr. Liesemer and Mr. Crockford to be available this morning, but on account of the time I see no object in putting either one of them on now at this

stage. I mention that now so that in planning for tomorrow you also have that in mind. I do not know where our schedule is at right now.

(Go to page 766.)

THE CHAIRMAN: If Prairie Pipe Lines and the Westcoast Transmission will be on the morning, I was wondering if possibly Mr. Liesemer or Mr. Crockford could give theirs today and finish them in the morning before going on with the others.

MR. McDONALD: If I may interrupt, I would like very much if Dr. Hetherington can be heard tomorrow. He is leaving New York today and would like to leave tomorrow night for the reasons I explained to the Board.

THE CHAIRMAN: I do not think there will be any difficulty about that. We will sit the whole day.

MR. McDONALD: Dr. Nauss is ready and can be taken any time.

THE CHAIRMAN: We can get Dr. Nauss on now.

MR. McDONALD: We can start now, if you like.

DR. ARTHUR W. NAUSS, having been first duly sworn, examined by Mr. McDonald, testified as follows:

Q This submission, "Second of Additional Data on Reserves with Particular Reference to Developments since April 1950", this is supplementary, sir, to the two previous submissions made by Dr. Nauss in the Westcoast hearing.

THE CHAIRMAN: Number that J-29.

SECOND OF ADDITIONAL DATA ON RESERVES WITH PARTICULAR REFERENCE TO DEVELOPMENTS SINCE APRIL 1950 MARKED EXHIBIT J-29.

MR. McDONALD: I would also like to tender, sir, the revised Table A, revised November 6th, 1950.

REVISED TABLE A PUT IN AND MARKED EXHIBIT J-30.

Q Dr. Nauss, the submission J-29 contains particulars of the additional reserves which you have added to your Table A, which is now marked J-30?

A Yes.

Q You have added the Brandi field, the Campbell field located just north of St. Albert, the Chip Lake field, Joseph Lake field, the North Woodbend field, and the Whitelaw field. Now, Exhibit J-29 also contains further comment with regard to the Excelsior field and the Redwater field?

A Yes, that is correct.

Q I do not know, Mr. Chairman, if there is any purpose in going over these fields individually.

THE CHAIRMAN: I was wondering, in connection with J-30, if any attempt had been made in any of those exhibits to follow the Board's request to segregate those reserves between the three categories, deferred on account of requirements for pressure maintenance or for other reasons having to do with the optimum recovery of oil or condensate; within economic reach of a market, pipe line or practical grid system; beyond economic reach of a market, pipe line or practical grid system.

MR. McDONALD: That, sir, is contained in Dr. Hetherington's submission.

THE CHAIRMAN: Does it relate to these fields in any place? In other words, that shows the total amount

of reserves here of marketable gas. Is it segregated into these three categories? Has that been done?

MR. McDONALD: No, we have not taken all of these fields, sir.

THE CHAIRMAN: In other words, you have selected certain fields?

MR. McDONALD: From this table.

THE CHAIRMAN: There is no place that shows the segregation of those reserves into the classifications that we asked for?

MR. McDONALD: Not on Table A as it stands here.

THE CHAIRMAN: Your marketable gas, what is now meant by marketable gas?

MR. McDONALD: That would be the recoverable gas at the well-head, at the field gate of any particular field. We do not suggest for a minute, sir, that this is pipe line gas.

THE CHAIRMAN: Sorry I interrupted you. I do not think it is necessary for Dr. Nauss to read any of those tabulations unless there is anything particularly, Dr. Nauss, you want to draw to the attention of the Board.

Q MR. McDONALD: I might mention the changes made in the Excelsior field and I think it is on page 5.

A During the past few months there has been additional development in the Excelsior field and we made a re-study of the reserves of that area and revised the reserves from 26 billion to 37 billion cubic feet.

Q You have made a revision with regard to the Redwater field?

A Yes. In connection with the Redwater field a great deal of additional drilling has been done and the area has been extended to 32,640 acres. In addition, the thickness has been revised to 85 feet. We recorded the thickness as 100 feet and we have given a re-study and decided that the average thickness of the Redwater field is 85 feet. The total productive acre feet is 2,774,400 and the recoverable dry gas per acre foot is 52 MCF. That is on the basis of our previous calculations. That changes the dry gas reserves to 144 billion cubic feet. As we mentioned before, the recovery of that gas is a matter of economics, and I notice in the Conservation Board's records for June that 4 million cubic feet per day of gas is being flared at Redwater, which is an appreciable amount and if the price for the gas were sufficient it might be economically gathered. It is a matter of economics.

Q THE CHAIRMAN: Are you concerned with the matter of what price you would make it?

A No, sir, I have not made that study.

Q MR. McDONALD: Then if you turn to the Pouce Coupe field, page 14.

A During the past few months - -

Q Just a moment, Dr. Nauss. I should point out to the Board that this field is covered in an earlier report but it was not covered in detail. We have now added the detailed data on the wells drilled and the structural contour map on the top of the Viking sandstone. I think, Dr. Nauss, if you explain at this stage how you arrived at the area which you included in your estimate and which is included

within the heavy line on the contour which is marked "Plate 9".

A Well, the first step in the process was to contour the top of the producing sand and that contour map is presented on Plate 9. Then the occurrences of gas were studied in each of the wells and it was found that gas occurs to within a very close distance of 140 feet below sea level. In Peace River, Alberta, No.2, you will notice that that well is a producing well on the 110 foot contour. You will notice that we have placed the edge of the pool at the 140 foot contour, which is only 30 feet below the elevation of the top of the sand in that well. Consequently, in that particular area it is very doubtful that you would obtain water-free production from that well if the water level were any higher at all, so that has been one of the main points in establishing a water level. When you take the 140-foot contour you get an area, as we reported before, of 17,105 acres. This contour map, we had not presented this contour map at the previous Hearings. Now, during the past several months a well was completed, PRNG Wilrich No.1, was completed in legal subdivision 15 of Section 21. That is one mile north of PRA No.3 well shown in this map. That well encountered the top of the gas at an elevation of 2157 and had gas. I said an elevation of 2157, I mean, a depth of 2157, and the well encountered gas down to 2188. That gives a total thickness of 31 feet for the gas sand, which is considerably more than the average we used. The average thickness we used was 26 feet.

This is the first well in which the thickness of the gas sand could be reliably measured. Most of the other wells did not penetrate entirely through the gas sand, so that the subsequent data confirms our original estimates of the field, which is 122 billion of marketable gas.

Q Now, Dr. Nauss, I think if you read from page 28 to the end. Have you a printed copy?

A Yes.

Q I do not suppose it is necessary to read it, Dr. Nauss, if you just refer to the Whitelaw field in particular.

A The most outstanding discovery during the past summer was the Whitelaw well. Whitelaw is located 30 miles southwest of the town of Peace River and this well encountered gas in the Triassic sandstone and oil in the sandstone of possible Pennsylvanian age. The gas occurs throughout a thickness of 500 feet of which 170 feet is porous. You will notice that the first drill stem test was taken - - the top of it was about 3300 feet and the bottom of the last drill stem test was 3900 feet. In the centre of that interval at 3560 one drill stem test obtained some salt water.

(Go to page 772)

Just below that they went into a shale break, and again into porosity, and found that porosity contained gas down to the top of the oil sand at 3890. The upper porous zone there has a thickness of 110 feet porosity as determined from the electriclog, and the lower one has a thickness of 60 feet. The reserve calculation based on these thicknesses and taking an area of 2000 acres around the well, gives a figure of 179 billion cubic feet of gas.

Q Yes?

A

PEACE RIVER AREA

Exploration of this large area is only now being started and a large development can be exoected in the near future. Although this area contains prospects every bit as good as those in the more highly developed areas to the south in Central Alberta, large gas reserves have not yet been developed merely because of lack of drilling. Geologists predict that large reserves will be developed because of the fact that a study of the few wells which have been drilled and of the outcrops exposed along the various rivers and streams which cut through the area, indicate that the sediments present are similar in nature, and geological structure, to those occurring in the Edmonton area.

Several years ago the only indication of gas was the several burning wild wells in the valley of the Peace, north of Peace River town, and the various showings in about twenty wells drilled in that area. Since that date a small gas field has been developed in the Cretaceous

of the Pouce Coupe area. An oil discovery was made at Normandville and during the drilling of the discovery well important gas occurrences were noted which could develop into a significant gas reserve.

WHITELAW FIELD

At Whitelaw, during the past summer, a gas reserve known to be of prime importance and as yet undefined as to area was discovered in an entirely new formation, the Triassic. Further confirmation of the great potential of this particular area was obtained in the occurrences in the Royce and Valleyview wells.

The proven reserve as indicated by the Whitelaw well has been estimated at 179 billion or about 60 billion per section. The successful drilling of the Bluesky well four and one-half miles to the southeast, where a proven reserve of 70 billion is indicated by estimates based on electrologs and drillstem tests, assures the probability of the gas producing area extending at least that far to the southeast. The probable reserves indicated by these two wells is 423 billion or 672 billion combined proven and probable. This estimate does not include gas from the lower Cretaceous from the interval 2729 - 2754 in the Bluesky well.

The great thickness of the producing zone at Whitelaw indicates the field will cover a large area.

Gas occurs through a vertical interval of 230 feet in the upper zone. The average dip of formations on the plains of Alberta is ordinarily on the order of fifteen

feet per mile. With such a dip one would have to go fifteen miles away from the Whitelaw well downdip before the top of the producing formation dipped below the water level.

There is now drilling a well approximately eight and one-half miles east of the Bluesky well, and we understand a location for immediate drilling has been made some six miles north of the Whitelaw discovery well. The successful completion of either of these two wells could more than double the probable reserves of this area. Whereas additional drilling must be done in this area in order to determine the boundaries of the Whitelaw field, four to six wells whose locations were intelligently selected could prove up more than a trillion cubic feet of reserves with an attendant additional amount of probable reserve. These wells could and should be drilled within the next six months.

No estimate can be made of the ultimate amount of gas that the Peace River region might supply. However, the high incidence of success in the few wells that have been drilled indicates that many trillions of cubic feet can be expected.

THE CHAIRMAN: We will adjourn until tomorrow morning now.

(Hearing adjourned until 9.30 A.M. November 9th, 1950).